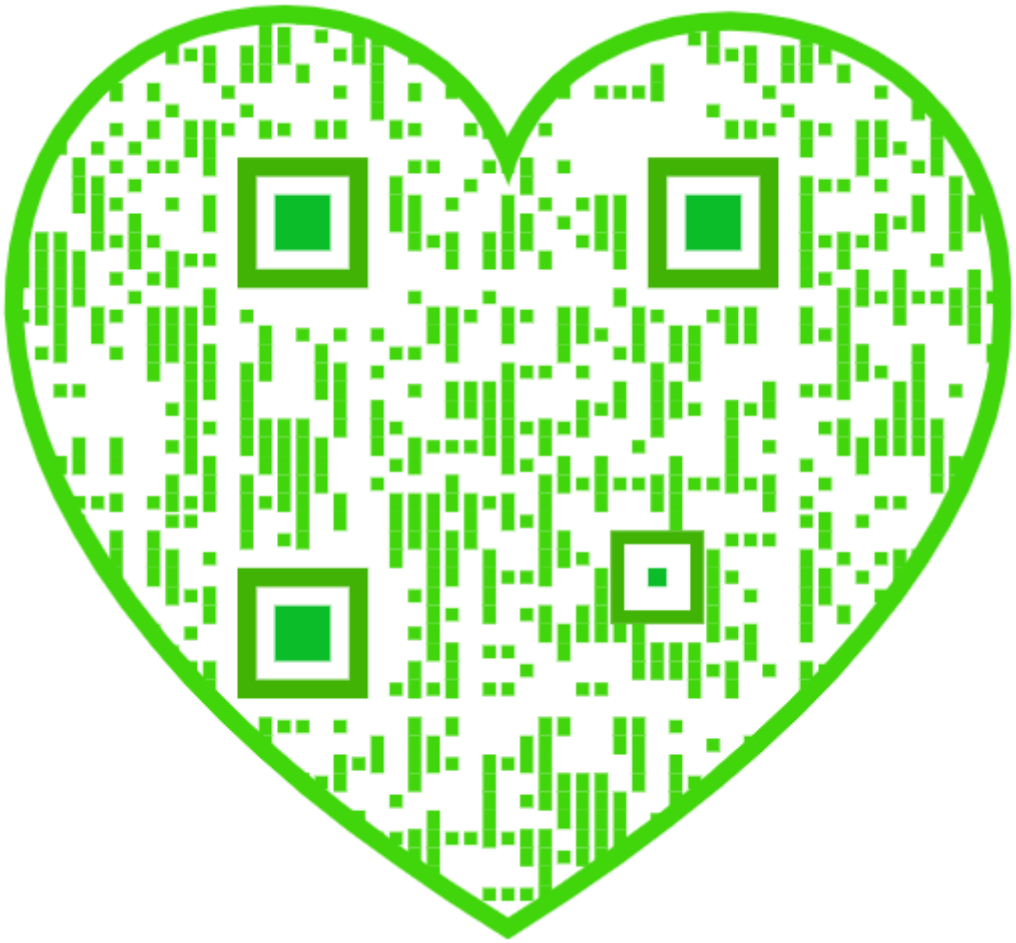
THE WOODWORKER SERIES

WOOD TURNING



THE WOODWORKER SERIES

WOOD-TURNING

PHILADELPHIA AND LONDON
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THE WOODWORKER SERIES

WOODWORK JOINTS.—Deals in the clearest and most practical way with all Joints required in Cabinet Work, Carpentry, Joinery, etc. The volume is illustrated with over 420 diagrams, many of which have been specially drawn to show the methods of work and the application of the joint. 12mo., with complete Index of over 1,000 references.

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FOREWORD

TURNING, one of the most effective and satisfying modes of ornament, has been employed from the earliest times in constructive and decorative woodwork, and this volume has been designed to assist the professional craftsman and the amateur in practical lathe work.

The uses of tools and the methods of manipulation for various classes of work are clearly given, and suggestions are offered as guidance for the setting out and grouping of the recognised classical members so as to secure correctly proportioned and graceful designs. The numerous illustrations include many examples of turnings in different styles, and in several cases full-sized working details are given.

The volume has been written and (for the most part) illustrated by Mr. William Fairham, and is aimed to assist not only the home worker, but also practical wood turners, cabinet makers, pattern makers, joiners, carpenters, wheelwrights, junior draughtsmen, and teachers and students in Technical or Day Continuation Schools.

J. C. S. BROUGH.

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THE LATHE

THE art of Wood Turning consists, broadly speaking, of forming timber into such a shape that, if a section be taken at right angles to the axis on which the work is revolved, the section will be a circle. The machine or appliance in which the timber is revolved whilst the cutting action is in progress is called a Lathe.

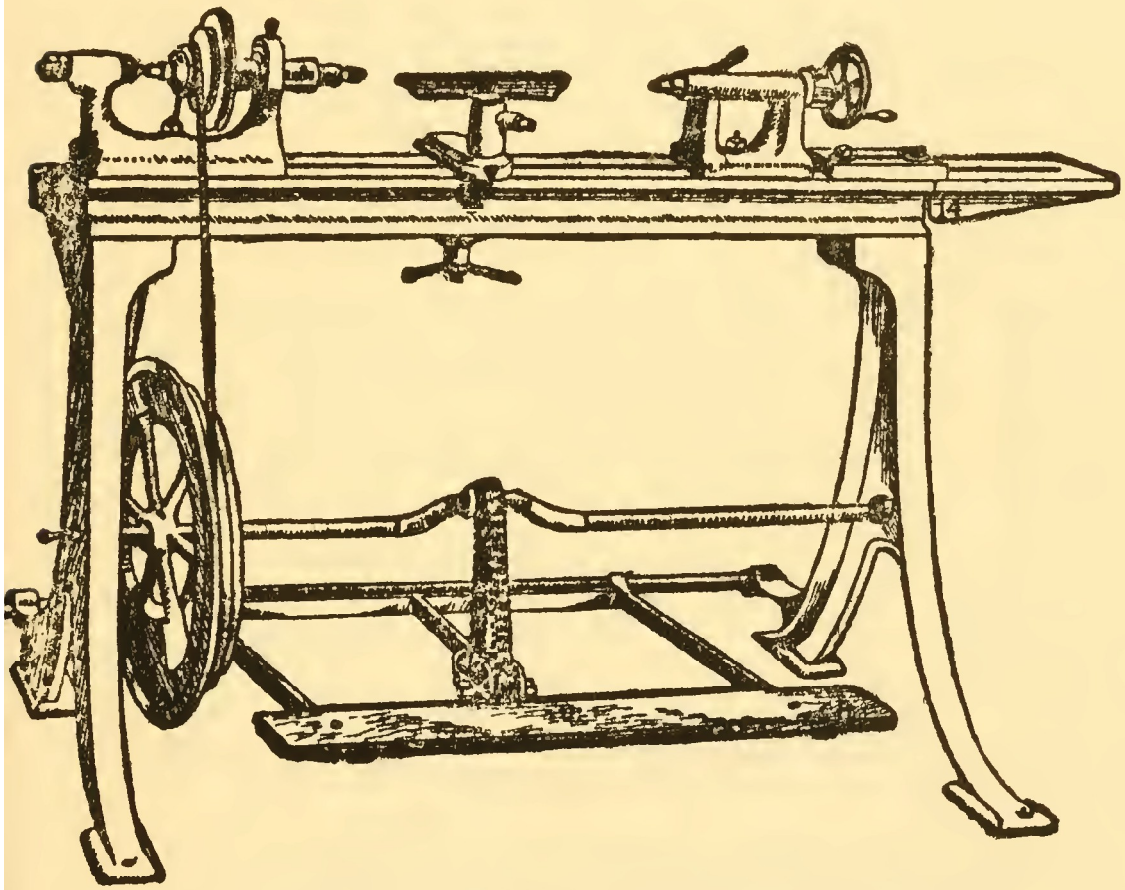


FIG. 1.—SKETCH OF STANDARD TREADLE LATHE, WITH EXTENSION PIECE.

Fig. 1 is a sketch showing the front view of a standard foot or treadle lathe. Fig. 2 illustrates the back view

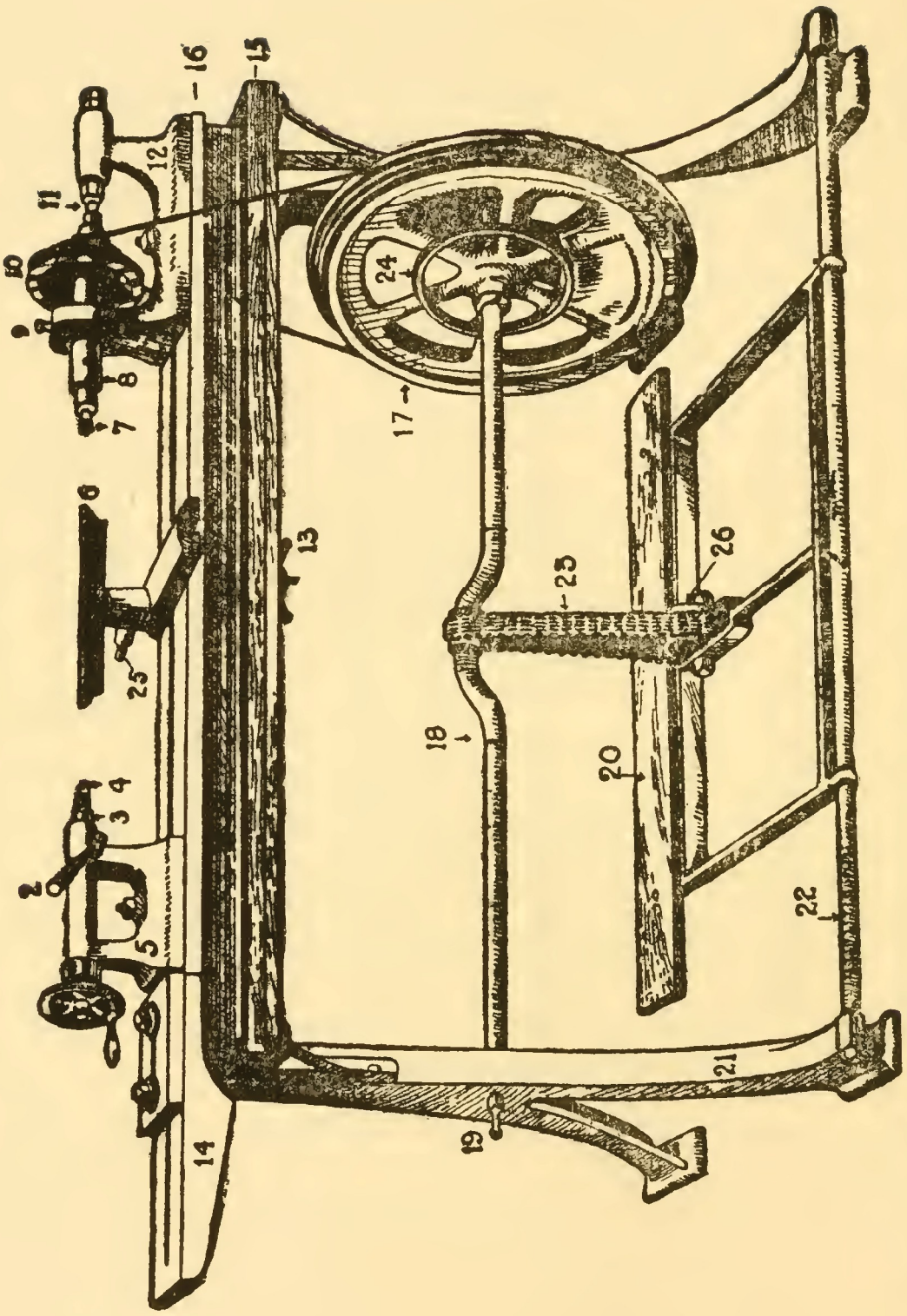


FIG. 2.—BACK VIEW OF LATHE, WITH PARTS NUMBERED ON OPPOSITE PAGE FOR REFERENCE.

PARTS OF LATHE, FIG. 2.

1. Handwheel to tailstock.
2. Locking handle to tailstock spindle.
3. Tailstock spindle.
4. The cup, or dead centre (see Fig. 3*a*, p. 4).
5. The tailstock.
6. The tee rest.
7. The live centre or prong. Also called the spur (see Fig. 3*a*).
8. Live spindle, with chuck to carry the prong.
9. Spindle lubricator.
10. Three-speed Cone pulley.
11. Thrust pin, and lock nuts.
12. The headstock.
13. Clamp to tee rest holder.
14. Extension to lathe bed. This portion may be removed when not required (see Fig. 3, p. 4).
15. Tool and calliper shelf.
16. The lathe bed.
17. Driving wheel.
18. Crankshaft.
19. Adjustable hardened centre pin, on which the crankshaft revolves. A pin of this type is fitted at each end of the lathe.
20. The treadle.
21. Lathe leg, or leg casting.
22. Treadle bar, forming the pivots for the treadle.
23. Revolving driving chain.
24. Slow speed driving wheel for metal turning.
25. Adjustable screw to lock the tee rest.
26. Chain wheel.

of the same lathe, a complete numbered list of parts being given on page 3. Various makes of lathes differ in design and construction, but the general principle is the same.

The length of the bed of the lathe shown in the illustration is 3 ft. 6 ins. ; and the height of the centres from

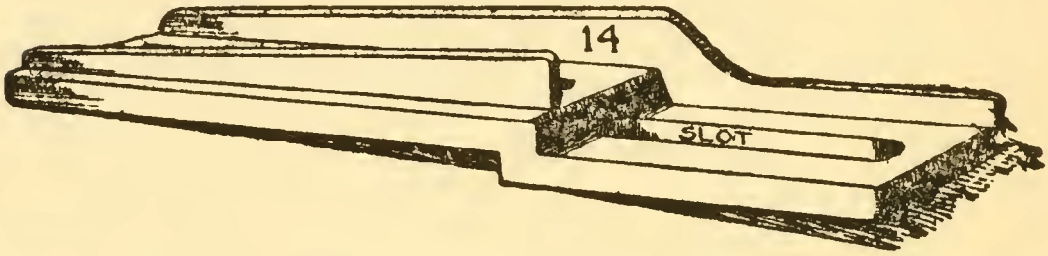


FIG. 3.—SKETCH OF EXTENSION PIECE (NO. 14).

the bed is 5 ins. The extension piece (No. 14) was in this particular case made after the lathe was bought, so as to enable the worker to turn table legs, etc., up to 2 ft. 8 ins. long. A sketch, Fig. 3, is shown of this extension, which can be bolted on and taken off the lathe proper as occasion demands.

FIG. 3*a*.—PARTS 4 AND 7 OF LATHE.

Buying a Lathe.—The points to be remembered when buying a lathe are these :—

Do not err by buying one that is too small and too lightly built. The height from the bed of the lathe to the centre of the spindle, and the distance between the centres (4 and 7) regulate, respectively, the diameter and the length of the work which is to be operated upon.

If your pocket will afford it, do not buy a lathe the

bed of which is less than 3 ft. 6 ins. long, and the height to the centres of less than 4 ins.

The whole of the moving parts should be accurately fitted. The driving wheel should be weighted, so as to bring up the treadle to such a position that it is always ready to be started by a direct downward pressure of the foot, and the cast-iron legs should be of a fairly heavy design. Lightly built lathes are useless for good work, as their construction is such that they do not absorb vibration.

The Operation of Shaping Wood by means of a lathe is as follows :—The timber to be turned is placed in the lathe between the live centre (7) and the dead centre (4). The treadle is started ; this transmits, by the action of the chain (23), the requisite power to the crankshaft and driving wheel. This, again, by aid of a leather belt or strap, turns the live spindle and so sets the wood revolving. A turning tool, generally a gouge, is firmly held by the worker with the blade supported by the tee rest, and the waste wood is cut away so as to leave the desired shape.

Make yourself familiar with the adjustments of your lathe. Slacken the nut at the centre of the tailstock, and note how readily the tailstock can be moved along the lathe bed so as to take the desired length of timber. Slacken the clamp (13) and you will find that the tee rest support can be adjusted so as to take varying diameters, or that it can be moved along the bed similarly to the tailstock, enabling you to bring it to any desired position lengthways on the bed. Slacken the screw (25), which allows the tee rest to be raised or lowered, and at the same time turned at right angles to the bed of the lathe.

Remember, before commencing work, that a lathe is in some ways like a bicycle, and that the moving parts require oiling so as to avoid undue friction.

Treadling. — Having made yourself familiar with

all the various parts of the lathe, your first difficulty will be learning to treadle. To the beginner it appears impossible to work the feet independently of the hands.

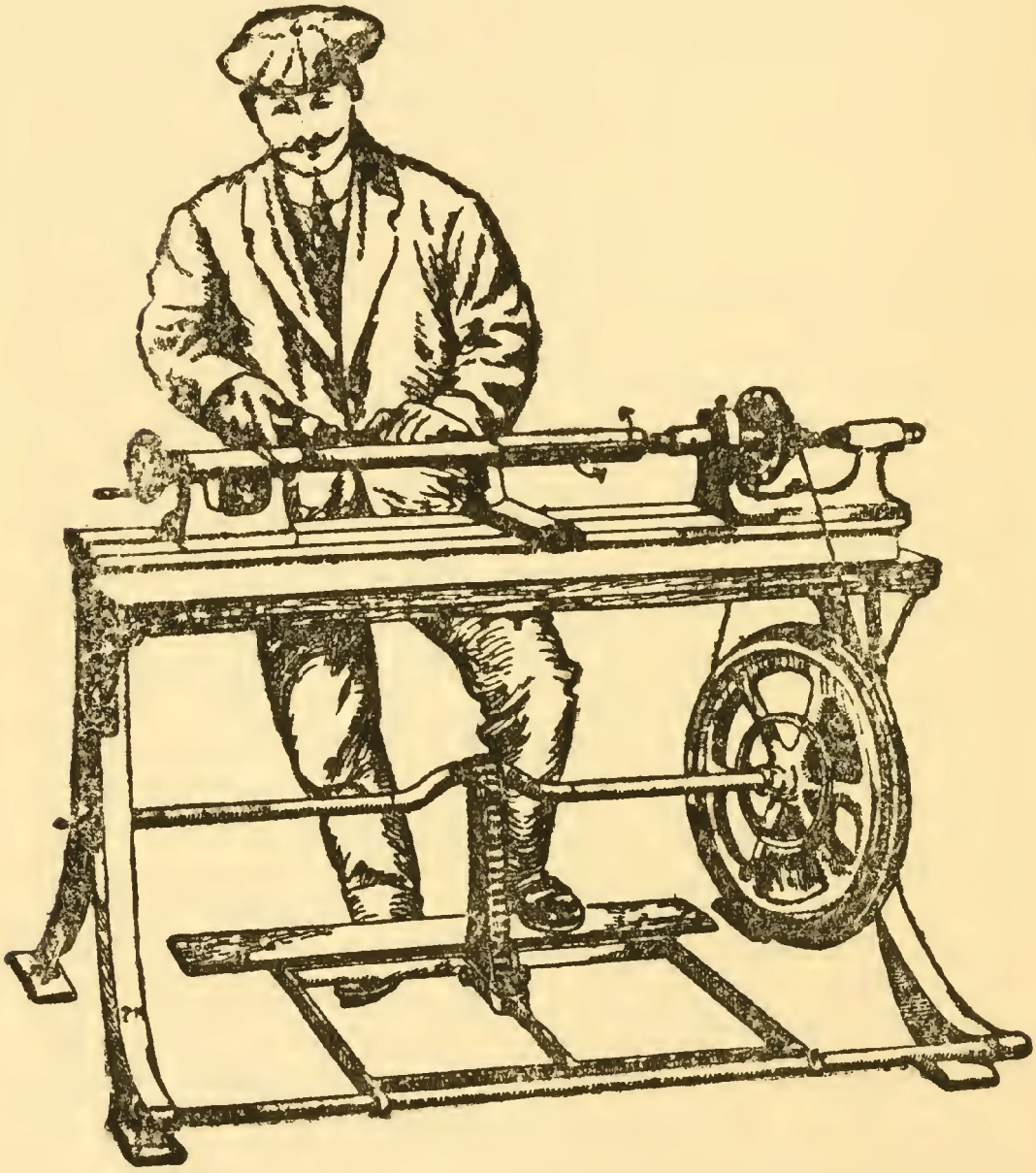


FIG. 4.—SHOWING POSITION OF BODY WHILST TREADLING.

It is, therefore, advisable to spend an hour or so in practising with the treadle before attempting the actual turning. Both feet should be used in turn, and this will

be found difficult at first. Much depends upon the poise of the body whilst changing the foot, and there is need for perseverance until easy and continuous running is obtained.

The great fault with the beginner is that he puts pressure on to the treadle before the crank passes the dead centre, thus working much harder than is necessary, or preventing the treadle from giving the crankshaft and flywheel a continuous revolution. Stand in front of the lathe (Fig. 4), the whole weight of the body on one leg ; work the treadle with the other leg, but moving no other part of the body in unison with the leg. When this can be done with either the right or the left leg without undue fatigue, the beginner may consider himself ready for his first attempt at wood turning.

Gauging and Chucking. — Take a piece of wood preferably of a soft nature, such as yellow pine or red deal. A convenient size for a first attempt will be about 12 ins. long by 1½ ins. square. See that the ends of the wood are approximately square and, taking up the ordinary joiner's marking gauge, strike the centre as shown at Fig. 5, these marks being, of course, gauged at each end of the wood. Next take up a bradawl and bore a hole about ¼ in. deep, so that the spur and the dead centre of the lathe will be forced into the timber without splitting it.

Considering that the lathe is foot driven, it is advisable to roughly plane away the corners of the wood as shown at Fig. 6 ; then, by making suitable adjustments to the tool rest and tailstock, proceed to place the timber between the lathe centres. This operation is called " chucking " the wood. Fig. 7 shows the wood held in the left hand while placing the centre point of the spur, or prong, in the centre of the hole already made for it.

Now give the end of the wood a couple of smart taps with a hammer or a spanner, and this will effectively drive the end of the wood on to the spur.

Take up a tallow or composite candle and grease the hole that has been formed to take the dead centre. It is important that this be lubricated, owing to the fact that the wood revolves on the dead centre, thus inducing

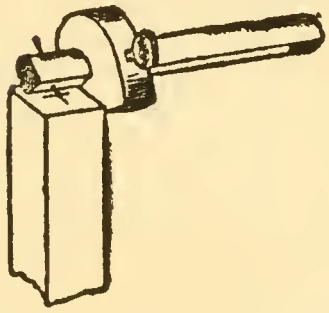


FIG. 5.—GAUGING TO FIND CENTRE.

FIG. 6.—PIECE OF WOOD WITH CORNERS ROUGHLY PLANED AWAY READY FOR MOUNTING BETWEEN THE LATHE CENTRES.

friction. On the other hand, no lubrication is necessary at the end of the wood which engages with the spur or prong, because the wood is carried round, or revolved by this spur. Candle grease is considered much better

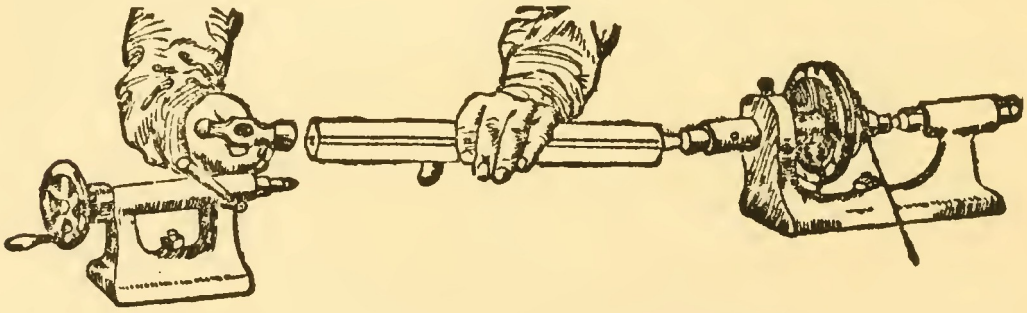


FIG. 7.—CHUCKING THE WOOD

for lubricating the dead centre than the ordinary machine oil, which, owing to its liquid state, runs all over the wood, thus messing up the turning and throwing oil into the worker's face.

Turn up the hand-wheel as shown at Fig. 8 until the conical point pushes fairly tightly into the wood, then

give the handle a quarter turn backwards to avoid excessive friction, and lock the tail spindle in the desired position by screwing up the locking handle shown at Fig. 2, No. 2. If the tail spindle be not locked, there is always a danger of the spindle working backwards, and

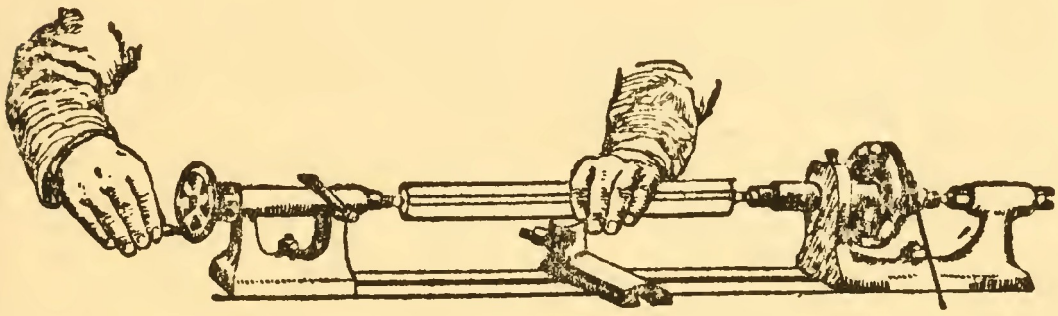


FIG. 8.—FASTENING WOOD BETWEEN CENTRES.

a risk of the wood flying out of the machine and injuring the worker.

The tee rest and the tee rest holder should now be adjusted to the work. This is done by raising the tee

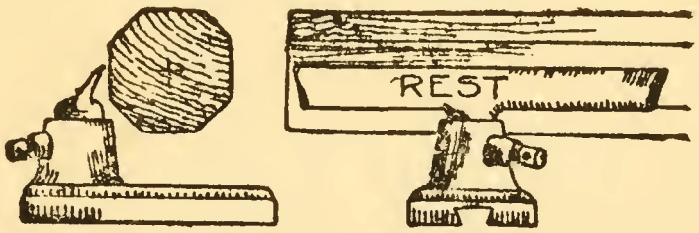


FIG. 9.—POSITION OF REST AND WOOD.

rest so that the top edge of it is slightly above the centre of the wood, and then adjusting the tee rest holder so as to allow the front of the rest to be as close to the wood as is possible, without actually touching it when the work is revolved. For positions of rest and wood, see Fig. 9.

Roughing Down.—Now take the ½-in. gouge as shown at Fig. 4, allowing it to lie with its back on the tee rest. Hold the right hand (which grasps the handle of the tool) close to the body, so as to overcome leverage, and let the fleshy part of the left hand come in contact with the tee rest so as to act as a guide and prevent the tool being pushed into the work unevenly.

Treadle the lathe so that the wood revolves towards you as indicated by the arrows in Fig. 4, and gently advance the gouge so that it takes light cuts off the rough

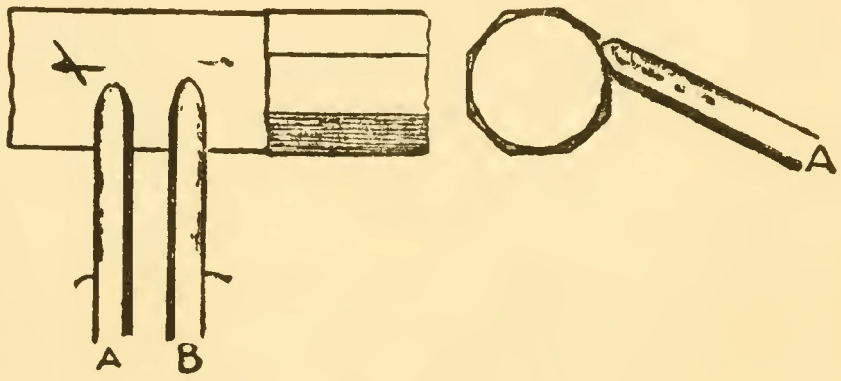


FIG. 10.—POSITION OF GOUGE WHEN ROUGHING DOWN THE WORK—RIGHT AND LEFT-HAND CUTS.

parts of the wood. Give it at the same time a sideway motion, and gradually cut deeper into the wood opposite the tee rest until it becomes cylindrical. The clamping handle, No. 13, Fig. 2, is now loosened so as to enable the tee rest to be placed opposite that portion of the wood which has not been worked upon ; fasten the clamp which holds the tee rest, and repeat the cutting operation until the whole of the wood is approximately a rough cylinder.

This tool operation is called " roughing down."

When roughing down, the tool should occasionally be reversed so as to bring the other cutting edge into use ; this method is shown in Fig. 10. The sketch shows a

top view and an end view. When the gouge is being worked to the left, as indicated by A, it is slightly tilted as shown by the curved arrow ; similarly, when working to the right, B, it is again slightly tilted as shown by the arrow. With constant practice this reversal of the tool becomes almost automatic.

The beginner will probably experience some little difficulty in using the gouge. He may fix his tee rest a little too high, or he may hold his gouge at an incorrect angle to his work. Should his tool rub upon the work without cutting, he should slightly lift the right hand.

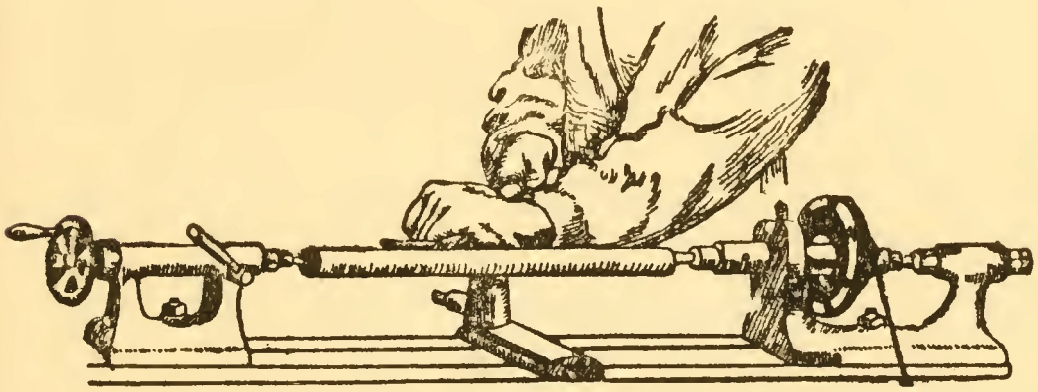
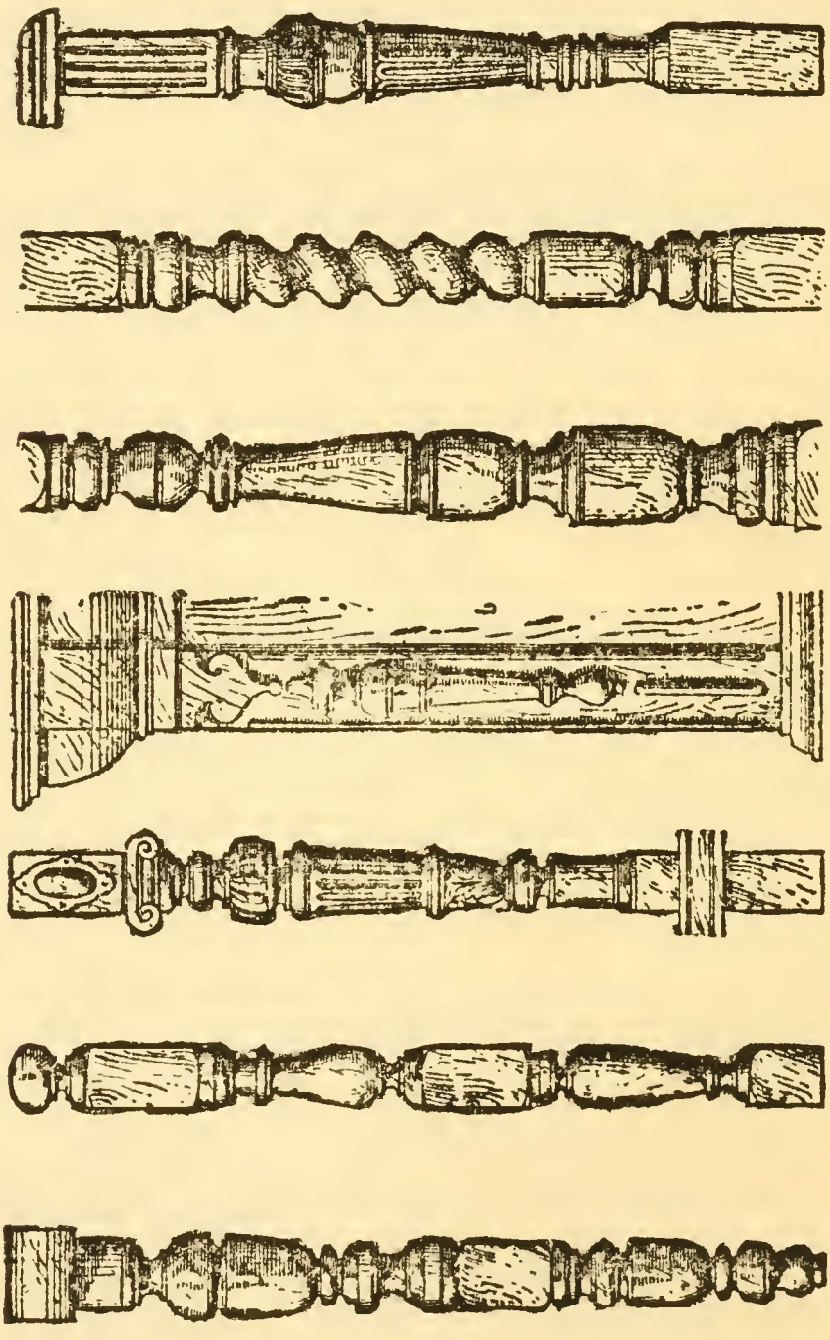


FIG. 11.—SMOOTHING WITH THE CHISEL.

A little experience will soon enable him to judge his correct cutting angle without any necessity for theoretical knowledge, such as cutting edges at a tangent to the cut circle.

After roughing down the work with the gouge, the worker should endeavour to make his work as smooth as possible by removing the irregularities which have been left by the roughing process. This can be done by taking a very light cut with the gouge, and allowing the left hand to slide along the front of the tee rest ; in fact, the left hand will act as a kind of slide rest. With practice an almost finished surface can be left from the gouge alone.



EXAMPLES OF TUDOR PERIOD TURNINGS.

TURNING SMALL OBJECTS

IN the previous chapter we described the wood-turning lathe and its various parts, and dealt with the work of the gouge in " roughing out " for the initial stages. The next tool to be used is the turning chisel, and as an introduction to this tool the worker is advised to use it on the cylindrical block that he has already experimented upon (Fig. 6). His first use of this tool will be an attempt to finish off his work.

The Chisel.—Most amateurs use the chisel as a *scraping* tool. Perhaps they have not seen it used as a

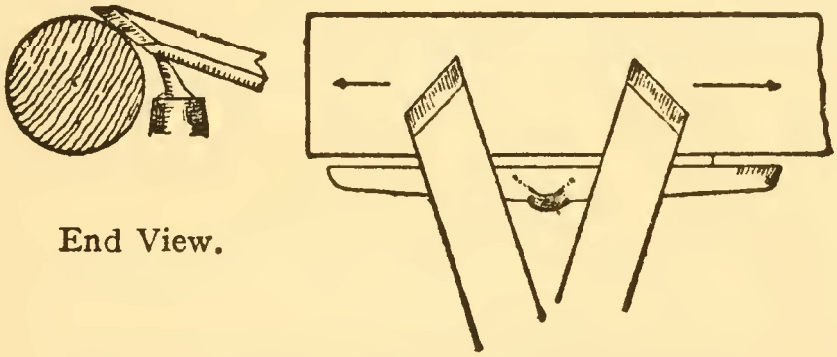


FIG 12.—FINISHING WORK WITH THE CHISEL.
(RIGHT AND LEFT-HAND CUTS.)

cutting tool, and many who attempt to use it as a cutting tool experience great difficulty, owing to the liability of the sharp corners to continually catch and dig into the work.

The secret of using this tool for smoothing purposes is to remember that only the centre portion of the blade should be actually touching the wood. Fig. 11 indicated the method of using it when making a finishing cut, and Fig. 12 shows the actual position and the approximate angle of the tool for cutting to right or left.

Before the finishing cut has been going on many

minutes, the worker will probably find that the long corner of the chisel will catch into the wood, thus splintering it to a greater or lesser extent, according to how firmly the handle is being held. This is one of the traps for the beginner, and the best safeguard is to use a chisel

FIG. 13.—AN ELEMENTARY TURNED SHAPE.

not less than 1-in. in width. Nervousness is a cause of a great deal of spoiled turnery work.

As a second attempt, take the gouge and rough down the work similar to the shape shown at Fig. 13. Practise taking a finishing cut with the chisel, working from the centre of the block to the ends and using the chisel both to the right and left from the centre. Remember, as a

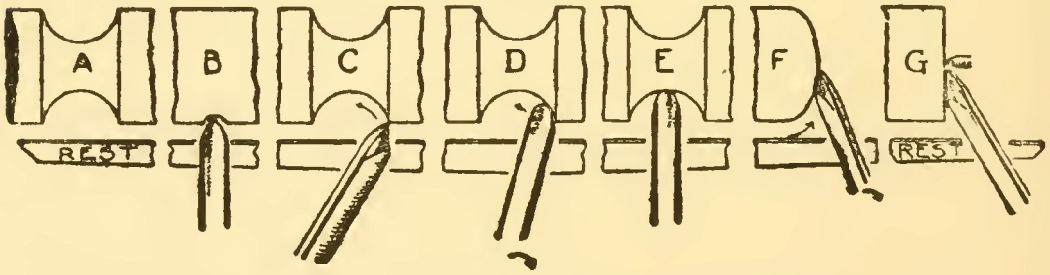


FIG. 14.—STAGES IN TURNING A HOLLOW, ETC.

general rule, to keep the tee-rest as near to the work as possible, say $\frac{1}{8}$-in. clearance, and bear in mind that, as the block is reduced in diameter, you must adjust the rest so as to follow up the continually diminishing diameter.

The worker should continue practising with the gouge and the chisel until the wood is reduced to such a size that it has to be discarded.

Turning a Hollow.—Next try to turn a hollow with a $\frac{3}{8}$-in. or $\frac{1}{2}$-in. gouge. Fig. 14, A, shows the completed concave curve. B shows the method of using the gouge to give the first or opening cut, and this cut is gradually widened out until it is ready for the finishing cut. C illustrates the commencement of the finishing cut ; the gouge is held so that the cutting edge is vertical, and at the same time (as the gouge is worked forward into the hollow) the right hand twists it, as indicated by the arrow at D. This twisting of the gouge is continued until reaching the deepest point of the concavity, at which point the gouge will be on its back, as indicated at E.

The left-hand half of the hollow is worked out by starting at the left of the cut and reversing the cutting operations, thus finishing the cut at its smallest diameter. The general rule to be remembered is to work "down-hill" as it were.

When starting the cut at C it is important that the tool be held at a correct cutting angle, and with the edge of the tool that is in contact with the work vertical. If the tool be advanced at an incorrect angle with the edge not vertical, the worker will find that it has a tendency to run along the face of the work, thus scarring the finished surface with an unsightly spiral cut which will spoil the work. For instance, if, when starting the cut C, the gouge is held as shown in position D, the power exerted by the revolving wood will twist the gouge flat upon its back and tear the wood away.

A considerable amount of practice will be necessary at this stage of the work, and it is important to firmly grasp the handle of the gouge with the right hand.

Rounding Off.—Next attempt rounding off the end as shown at F. Start the cut with the gouge almost flat upon its back, twisting the handle of the gouge to the right at the same time as the point goes towards the

centre of the wood. This will bring the gouge into the position shown at F—that is, with the cutting edge in contact with the work, vertical.

Squaring Down the end of the wood with a gouge is shown at G, and from start to finish of this cut the edge of the gouge is held in a vertical position.

The reader will clearly understand that all the above tool operations, although shown in most instances working from left to right, can be manipulated from right to left by reversing the position of the tool.

Stepping or Sinking Down the work may next be attempted, such as recessing the handle of a dumb-

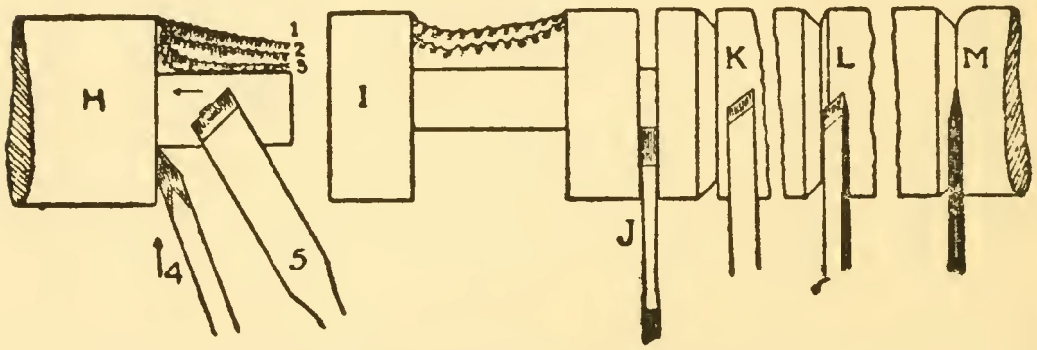


FIG. 15.—STAGES IN STEPPING DOWN OR SINKING; ROUNDING OFF A BEAD, ETC.

bell, similar to I. The gouge is first used to rough out the work in 1, 2, 3, or more cuts, as shown in the upper half of sketch H. After roughing in to the approximate shape, the shoulder is cut down by taking a light cut with the chisel as H, 4. The chisel commences the cut at the highest point of the turning and is advanced in the direction of the arrow until the required distance is set in, it is now turned upon its side and used as at H, 5. After finishing out the corner, the chisels are used in an exactly opposite manner, to work away and finish the right-hand corner.

Where a very narrow recess has to be turned out, it will be necessary to use a parting tool, as at J.

Rounding Off a Bead with the chisel is shown at K, L and M. The tool is held at K, and by gradually twisting the handle to the left, as shown at I (see arrow), the tool will assume the position shown at M, which is the completion of the cut. The ordinary vee cut is made with the chisel (N, Fig. 16). For the first cut or incision, hold the cutting edge perfectly vertical, then

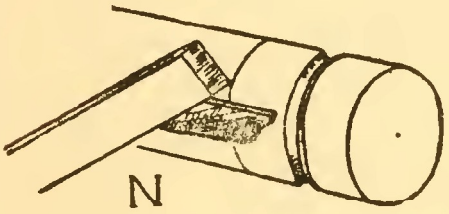


FIG. 16.—A VEE CUT.

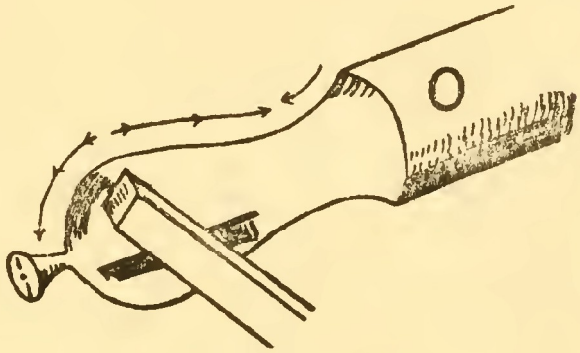


FIG. 17.—SHOWING DIRECTION OF TOOL.

take a cut at each side of this centre line in a similar position to that shown at L.

For Finishing Tool Handles or similar articles of spherical or semi-spherical shape the chisel is used. Start with the tool flat upon its side as at K (Fig. 15), and gradually twist the handle, as at L, until at the finishing point the edge of the chisel is vertical as at M. Fig. 17, O, shows the rounding of a handle, the position of the tool being about two-thirds of the distance down the cut. The whole of this handle would have the finishing cut given to it by the turning chisel, working from the highest points downwards as indicated by the arrows.

The worker will have to give considerable attention and practice of the use of the chisel for finishing, as it is

probably the most difficult of all turning tools to successfully manipulate. When a certain amount of freedom of cut has been attained by constant practice, he should attempt to turn one or two objects to certain dimensioned sizes, and for this purpose he will find the necessity of using the callipers.

Callipers.—Figs. 19, A and C, illustrate the same pair of callipers. At C the legs are simply crossed over so as to form a pair of *inside* callipers. At Fig. 18 a pair of

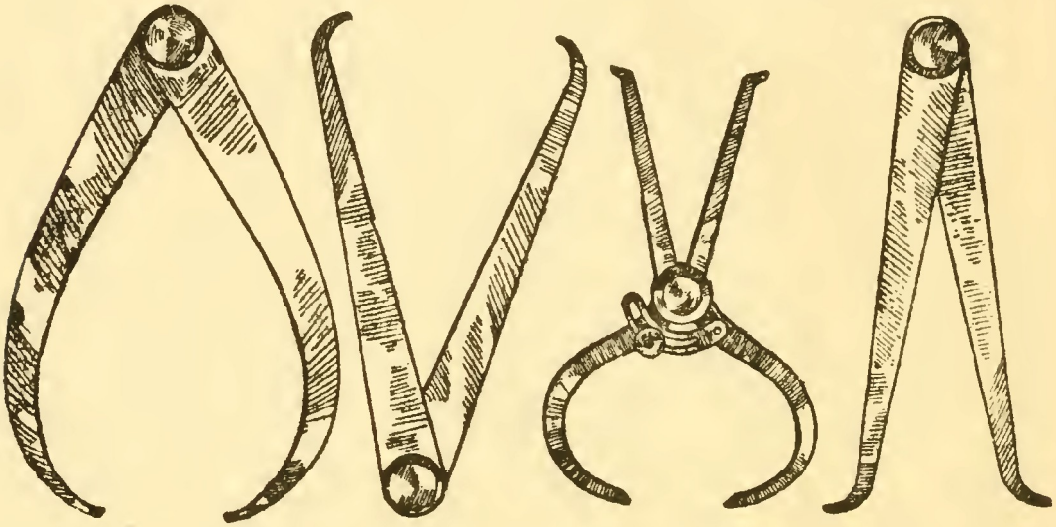


FIG. 18— EGG CALLIPERS.

FIG. 19A.— CALLIPERS.

FIG. 19B.— IN-AND-OUT CALLIPERS.

FIG. 19C.— CALLIPERS (19A REVERSED).

6-in. egg callipers is shown, whilst Fig. 19 B illustrates a pair of combined " in-and-out " callipers. In-and-out callipers, if correctly made, always show the same distance at each end ; thus, if the egg portion of the callipers be set to one inch, the inside callipers at the reverse end will also show one inch. This is of great advantage to the worker, because he can use the egg portion of the callipers to gauge the diameter of a turned pin, and, by simply using the opposite end of the callipers, he can gauge a hole to fit the pin without any further adjustment of the thumb-screw.

FIG. 20.—HANDLED WOOD TURNER'S GAUGE.

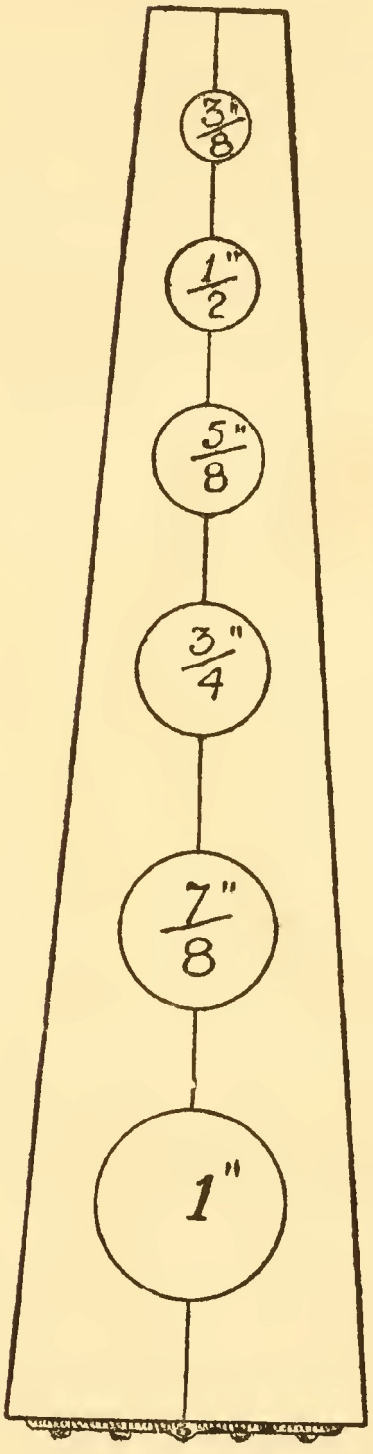


FIG. 21.—HOME-MADE WOODEN GAUGE.

. Fig. 20 shows the handled wood turner's gauge, which is a most useful tool where there is a great amount of repetition work to be done. For the callipering of general

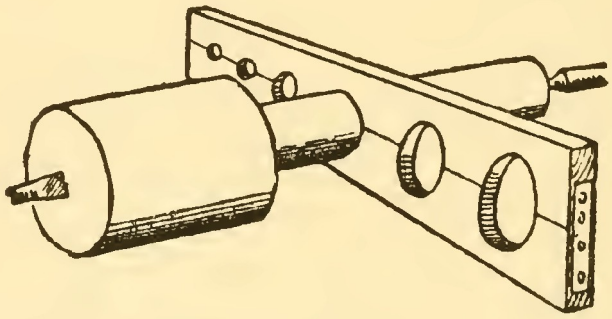


FIG. 22.—USING THE WOOD GAUGE.

work up to 1-in. in diameter, the home-made contrivance shown at Fig. 21 is very useful. A series of holes ranging from $\frac{3}{8}$ in. to 1 in. is bored in a piece of hardwood, which

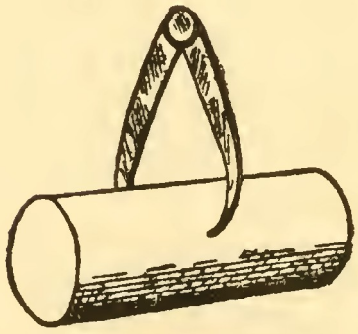


FIG. 23.—TESTING DIAMETER WITH OUTSIDE CALLIPERS.

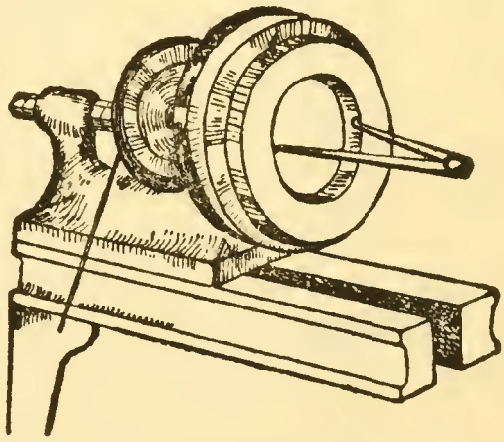


FIG. 24.—TESTING INTERIOR RECESS WITH INSIDE CALLIPERS.

may be about $\frac{3}{8}$ in. or $\frac{1}{2}$ in. in thickness. The centres of the holes are kept in a straight line, and the wood is then sawn down the centre with a very fine saw; the worker has thus a series of gauges, of graduated sizes, which

can be used in conjunction with his centre or twist boring bits. The end of this wooden gauge may be hinged as shown so as to prevent one of the pieces from being

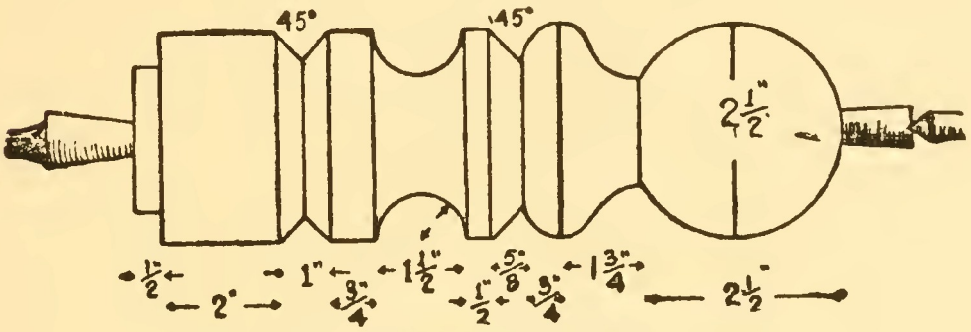


FIG. 25.—EXERCISE IN TURNED WORK.
(ALL DIMENSIONS ARE GIVEN.)

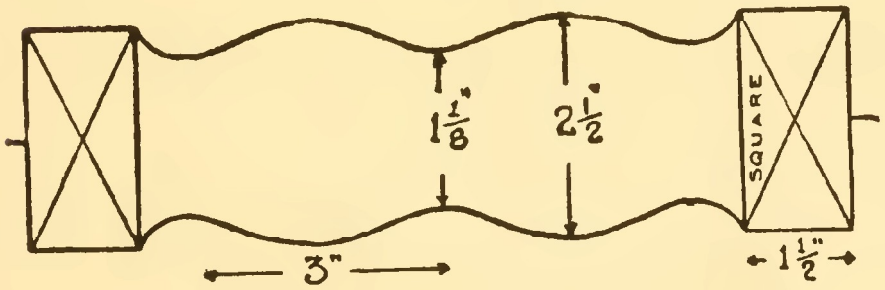


FIG. 26.—ANOTHER TURNING EXERCISE.
(THE END PARTS, WITH DIAGONAL LINES, ARE SQUARE.)

FIG. 27.—TURNING A CHISEL OR FILE HANDLE.

mislaid or lost. The method of using this gauge is to open it and place it around the work as shown at Fig. 22. The egg callipers are used by passing them around the work as at Fig. 23. (The lathe, of course, is stopped

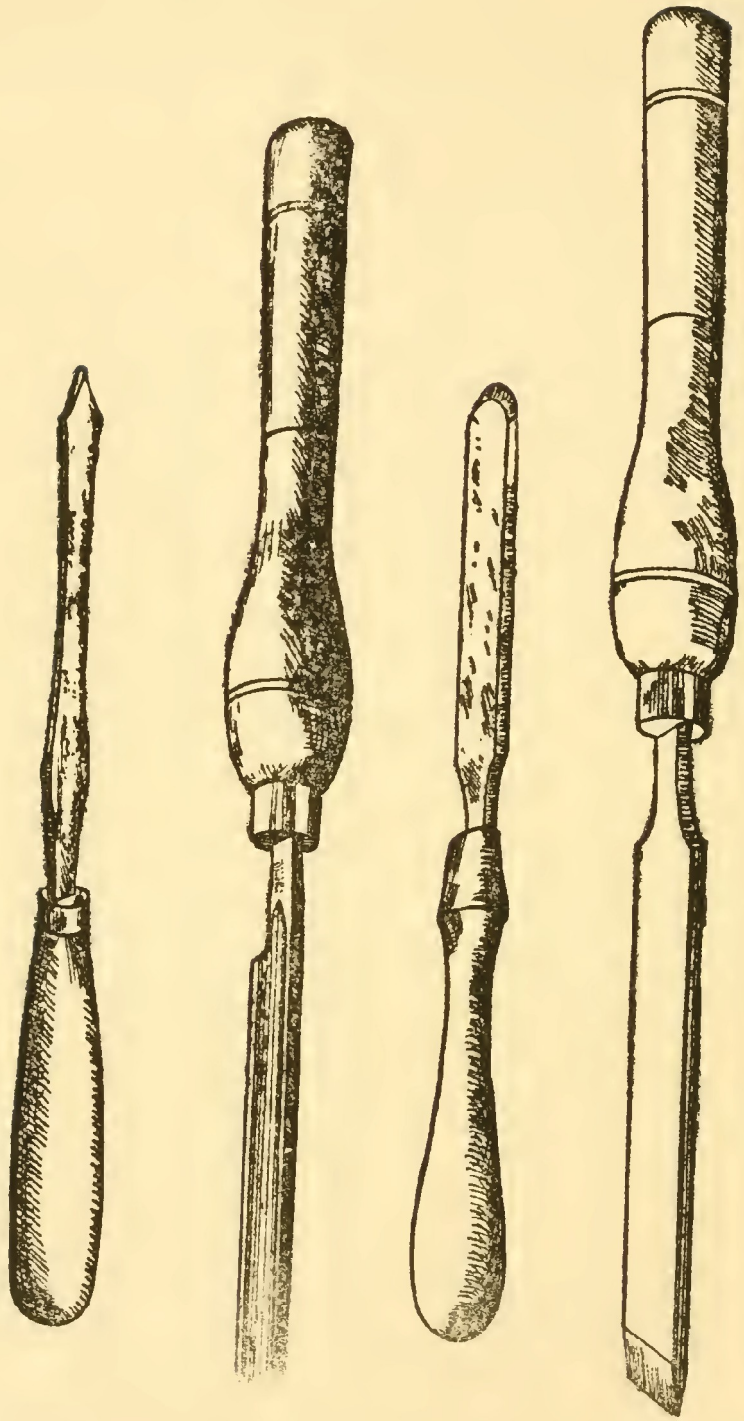


FIG. 28.— PARTING TOOL.

FIG. 29.— TURNING GOUGE.

FIG. 30.— SCRAPING TOOL.

FIG. 31.— TURNING CHISEL.

during the testing operation.) The inside callipers are used for obtaining the diameter of an internal recess, as, for instance, that shown at Fig. 24.

Examples.—The turner is now advised to try one or two examples, such as those given at Figs. 25 and 26, to the dimensioned sizes. Note that, where diagonal lines are drawn on turning patterns, it means that these portions are to be left square. The turner at this stage will probably desire to try his hand on such objects as chisel and file handles. If this is the case he should first slip his brass or steel ferrule over the end of the dead centre as shown at Fig. 27. This will facilitate the turning of the pin to fit the ferrule without the trouble of callipering the pin ; he can simply try the pin from time to time by sliding it on to the handle as indicated by the arrow. F denotes the ferrule in this drawing. Leave a piece at the left hand of the handle, about one inch long, so as to avoid damaging the edge of the tools on the live or running spur. When the handle is finished, and just before removing the turning from the lathe, this small piece may be cut away by using the turning chisel edgeways up.

Finishing with Glass-paper.—Turnings are finished by glass-papering. A piece of folded glass-paper is held in the hand and generally applied at the back of the work. Undulating work is followed by the fingers, and small squares, fillets, etc., are papered by folding the glass-paper and using the folded edge. The work may be first glass-papered with fine 2-grade glass-paper, and finished with No. 1½.

After completing the glass-papering, it is usual to grasp a handful of fine shavings which will have collected on the lathe, and by holding these shavings in the hand and grasping the work in a similar manner to that shown at Fig. 8 in the previous chapter the work is brought to a finish by friction (see also pp. 91 and 92).

Rolling pins, potato mashers and, in fact, any turnery that is going to come in contact with water, should be treated as follows. After finishing, as described above, take a sponge or rag, which has been dipped in hot water and wet the whole of the surface of the turned article. Allow this to thoroughly dry, and then repeat the glass-papering and friction polishing process. After this treatment the grain of the wood will have no tendency to rise when it comes in contact with moisture.

Tools.—Fig. 28 shows a parting tool, Fig. 29 a $\frac{5}{8}$-in. turning gouge, Fig. 30 a scraping tool for concave work, and Fig. 31 the wood turner's chisel. The methods of sharpening and grinding these tools are dealt with in the next chapter.

Many workers make scraping tools out of old files, and, as these can be easily made and re-ground to the required sections, they will be found most economical. Home-made tools should, of course, be mounted on handles of similar shape to the bought ones.

TOOLS:
GRINDING AND SHARPENING

IF good turning is to be accomplished, it is necessary that all the tools which are used should carry a keen, sharp cutting edge. In fact, many common turnery articles, such as file handles and chair spindles, are frequently left as finished direct from the tool, and for work of the above class a sharp finishing cut is absolutely necessary.

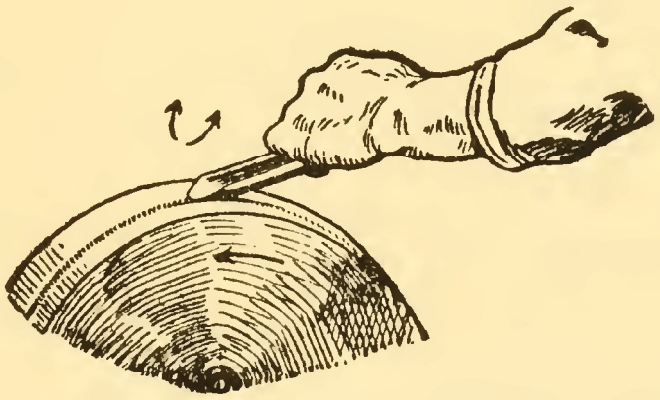


FIG. 32.—GRINDING A GOUGE. (METHOD ADOPTED BY TRADE OR PROFESSIONAL TURNERS. BY THIS METHOD RIDGES ARE WOVEN ON THE GRINDSTONE.)

For Grinding and Sharpening, the following appliances will be necessary:—A grindstone, an oilstone in a case, and a few assorted oilslips. The slips and oilstone may be the well-known "Washita," or "India medium" variety.

The trade or professional wood turner usually grinds his gouges as shown at Fig. 32, and he very soon wears suitable ridges in the face of his grindstone so as to fit the various sizes of his turning gouges. This method is an excellent one for the professional turner; but it is less advantageous to the amateur, who, after grinding

his turning gouges to-day, may possibly desire to grind the iron of a smoothing plane the following day, when he would experience considerable difficulty in obtaining a true cutting edge on his iron.

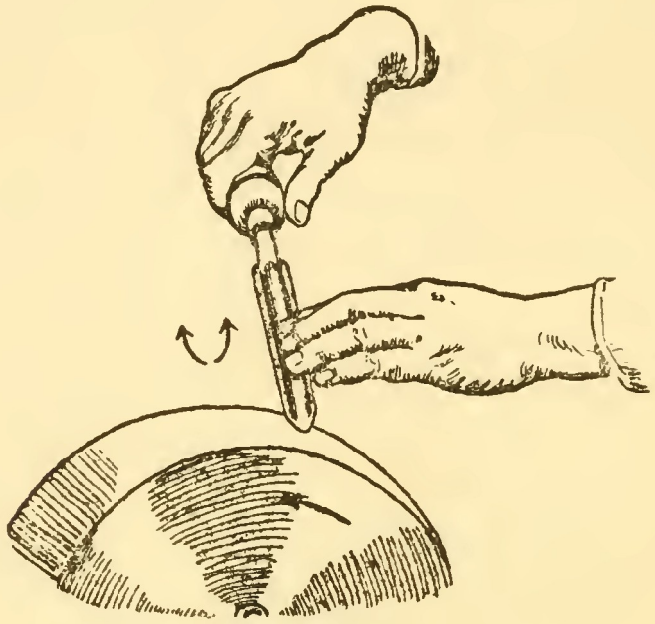


FIG. 33.—GRINDING A GOUGE.

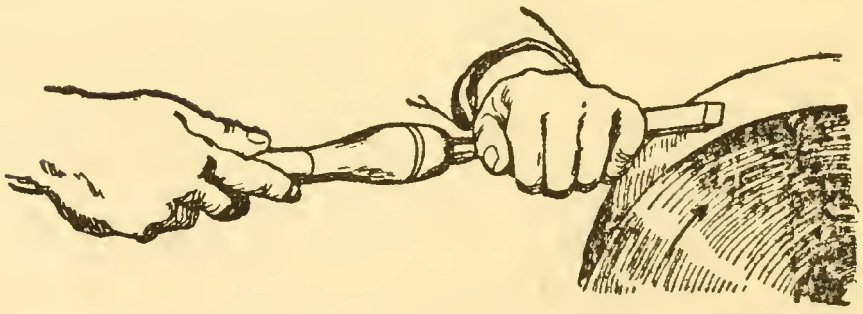


FIG. 34.—GRINDING THE TURNING CHISEL.

The difficulty of grinding a true wide blade on the face of a grindstone scored with ridges is apparent even to the beginner, and he is advised to grind his gouges as at Fig. 33. The direction of rotation of the grindstone

is shown, and the worker twists his right hand backwards and forwards, as indicated by the arrows. If the gouges are ground by this method, and the worker occasionally moves his gouges across the width of the grindstone, he will find little difficulty in keeping the face of the stone fairly even.

At Fig. 34 is illustrated the grinding of the turning chisel. This chisel is ground on both sides, and the approximate angle of inclination is shown at Fig. 35.

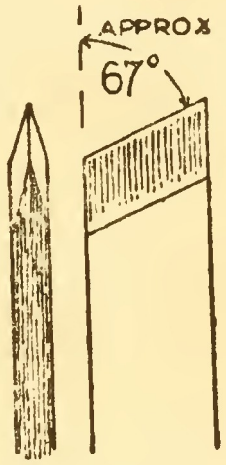


FIG. 35.—CHISEL EDGE.

During the whole of the grinding process a plentiful supply of water should be fed on to the grindstone so as to keep the steel blade cool, and to wash away the particles of ground steel from the pores of the stone.

Sharpening.—After grinding, the sharpening, or wetting, is attempted. The turning chisels are rubbed on the oilstone as shown at Fig. 36. The tool is sharpened from both sides, and the wire edge may be removed by pressing the cutting edge into a waste piece of hard wood. Some workers, after sharpening the tools, finish them off by stropping the edge on a piece of leather, but this is quite unnecessary unless the work

is for exhibition purposes, and has to be finished "left from the tool."

For sharpening up the gouges the tapered India oil

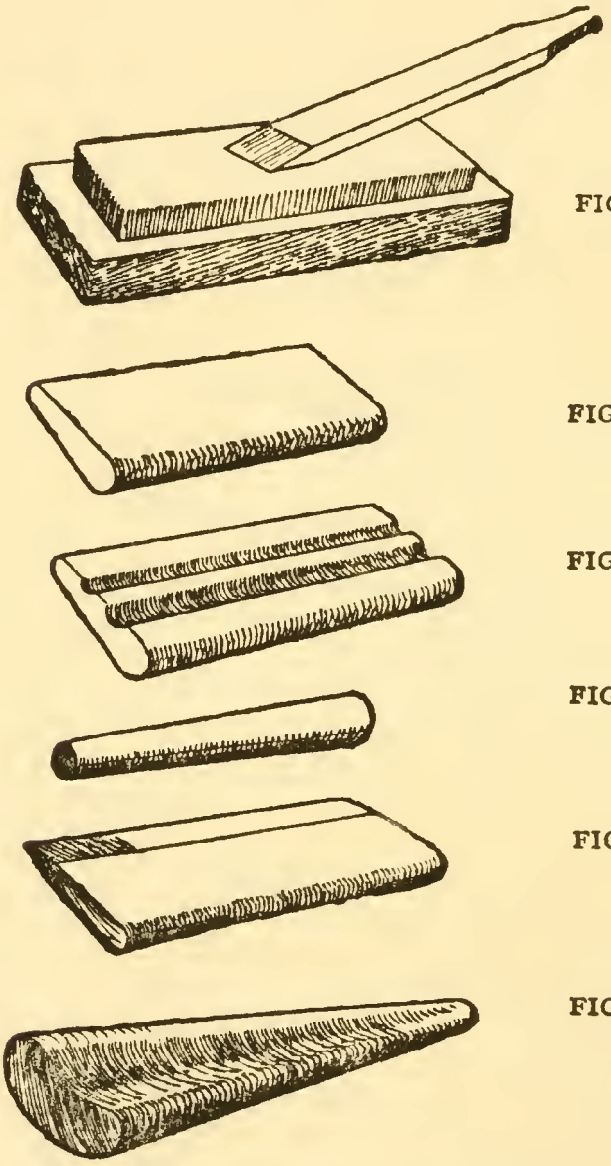


FIG. 36.—OILSTONE.

FIG. 37.—OILSLIP.

FIG. 38.—WORN OILSLIP.

FIG. 39.—TAPERED CYLINDRICAL OILSLIP.

FIG. 40.—OILSLIP WITH FEATHEREDGE.

FIG. 41.—TAPERED INDIA OILSLIP.

OILSTONES AND OILSLIPS.

slip illustrated at Fig. 41 is the handiest. This slip is 6 ins. long, convex on one side and concave on the other, and tapering uniformly to the point. It is used as shown

at Fig. 42 ; that is, with a to-and-fro motion, and at the same time a twisting movement as indicated by the arrows. After rubbing the outside of the gouge the

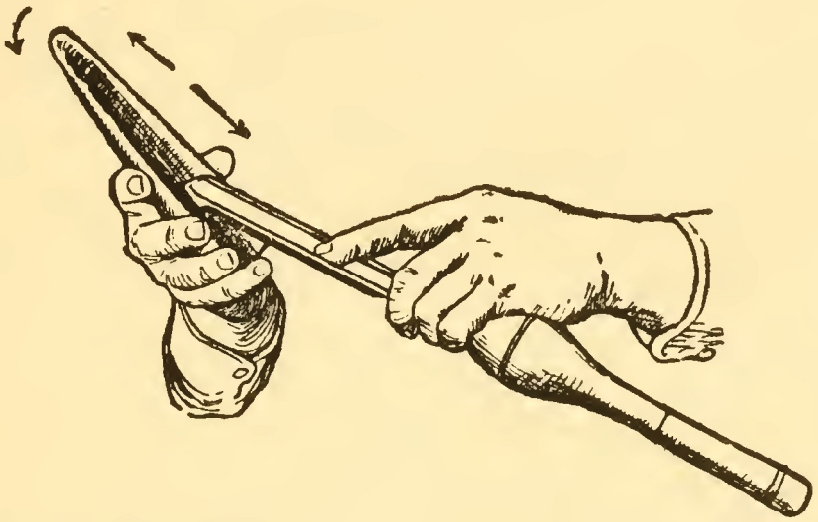


FIG. 42.—USING A CONCAVE AND CONVEX OILSLIP FOR GOUGE.

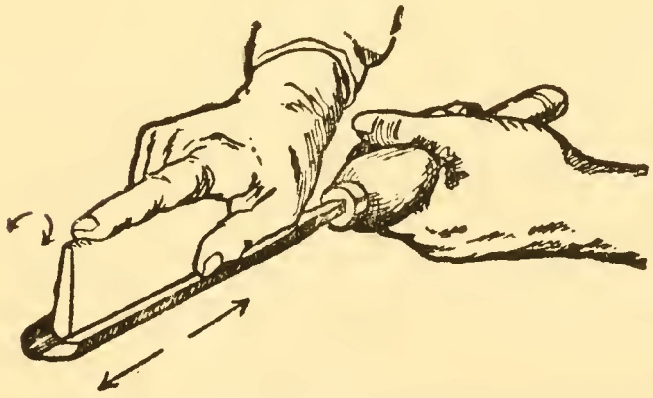


FIG. 43.—REMOVING THE WIRE EDGE FROM GOUGE.

wire edge is removed by taking an oilslip similar to Fig. 37 and using it inside the gouge, as at Fig. 43. Fig. 38 shows an oilstone similar to Fig. 37, with the exception that the former is worn by constant use to fit the outsides

of the $\frac{3}{8}$-in. and $\frac{5}{8}$-in. gouges. Fig. 39 shows a tapered cylindrical oilslip, and Fig. 40 illustrates an oilslip with a feather edge, used to sharpen vee-shaped turning tools. The beginner, however, will find that he can get along fairly well in the early stages of his work with the oilslips shown at Figs. 37 and 41.

Neat's-foot oil is considered to be one of the best lubricators for use with oilslips.

THE BACK STAY

SAWING AND BORING

FIG. 44 is an illustration of an adjustable back rest, and this is a very useful device for supporting long material, and thus ensuring a better result. It has a vertical adjustment of $1\frac{1}{2}$ ins. in the rest socket and a horizontal adjustment of $1\frac{1}{4}$ ins., and it will support work up to 6 ins. in diameter. The contact wheels are adjustable from zero to $2\frac{5}{8}$ ins. The

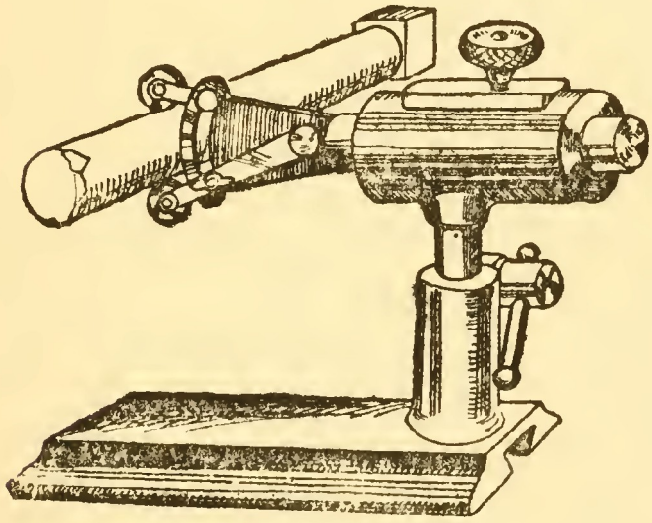


FIG. 44.—SHOWING THE ADJUSTABLE BACK REST.

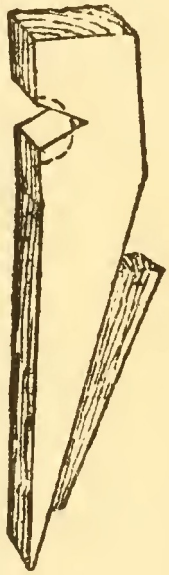


FIG. 45.—WOODEN BACK STAY.

base of this back stay is fitted on to the bed of the lathe in precisely the same manner as the tee rest.

Back Rest.—This accessory can be bought for about 37*s.* 6*d.*, and it is well worth the money to any one constantly engaged upon long, slender work, such as masts for model yachts, the delicate legs of fire-screens, batons for musical conductors, billiard cues, etc.

Back Stay.—Of course, it is not every amateur who can afford such an outlay, and if this be the case he will have to use the home-made wooden back stay shown at Fig. 45. This is generally made out of a piece of birch

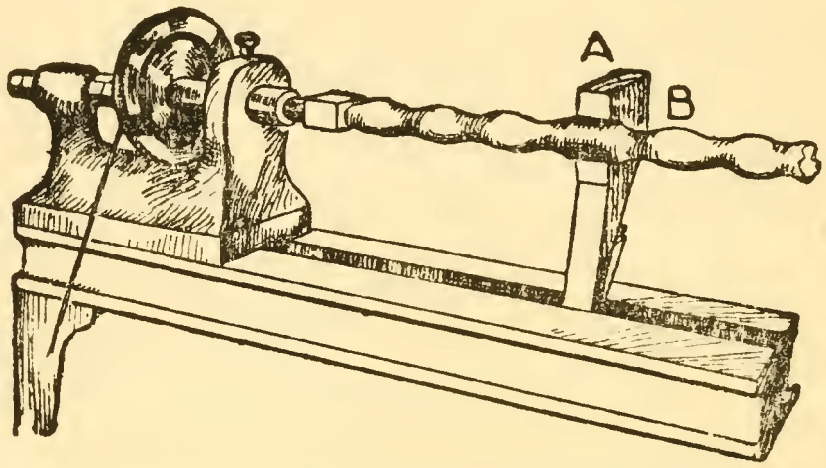


FIG. 46.—ILLUSTRATING USE OF BACK STAY FOR LONG SLENDER SPINDLES.

wood, about $\frac{7}{8}$ in. in thickness, the vee notch or semi-circular recess being cut in it to accommodate the particular piece of stock on which the worker is engaged. The method of fixing this home-made back stay to the bed of the lathe so as to support the work is shown at Fig. 46. A back stay is used to support slender work

FIG. 47.—CIRCULAR SAW SPINDLE.

so that it will offer a certain amount of resistance to the cutting edge of the tool. If no back stay be used the work will bounce away from the tool, and consequently the work will be rough and full of ridges; in fact, probably a fracture will occur.

The Back Stay

The following hints will be useful when the back stay has to be used. First centre up the work and fix the tee rest in such a position that it is in the centre of the proposed turning. Set the work revolving and bring the gouge carefully up to the work, taking very light cuts. The work will probably begin to spring away from the tool, and, if this is the case, hold the left hand behind the work so as to form a temporary back stay.

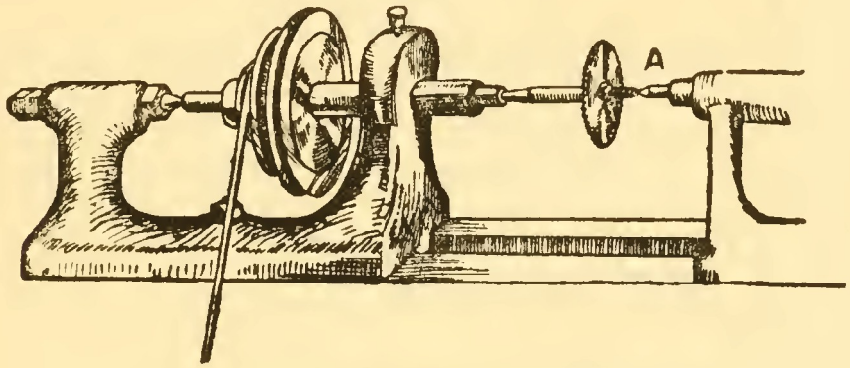


FIG. 48.—SAW SPINDLE AND SAW IN LATHE.

This will enable you to give the necessary resistance to turn the work cylindrical for a distance of about $1\frac{1}{2}$ ins.

Now stop the lathe and fix your back stay, as shown at Fig. 46; rub a little composite candle on the work so as to reduce friction where the turning runs in the back stay, and proceed with the turning in the ordinary manner. When the turning at each side of the back stay has been completed, remove your back stay from A to B (Fig. 46), and finish up the remaining member of the turning.

Without resorting to some such temporary appliance as a back stay, the worker will find it is quite impossible to turn long and slender work.

Circular Saw.—Much has been written upon the use of small circular saws in conjunction with the turning

FIG. 49.—BORING ADJUSTMENT.

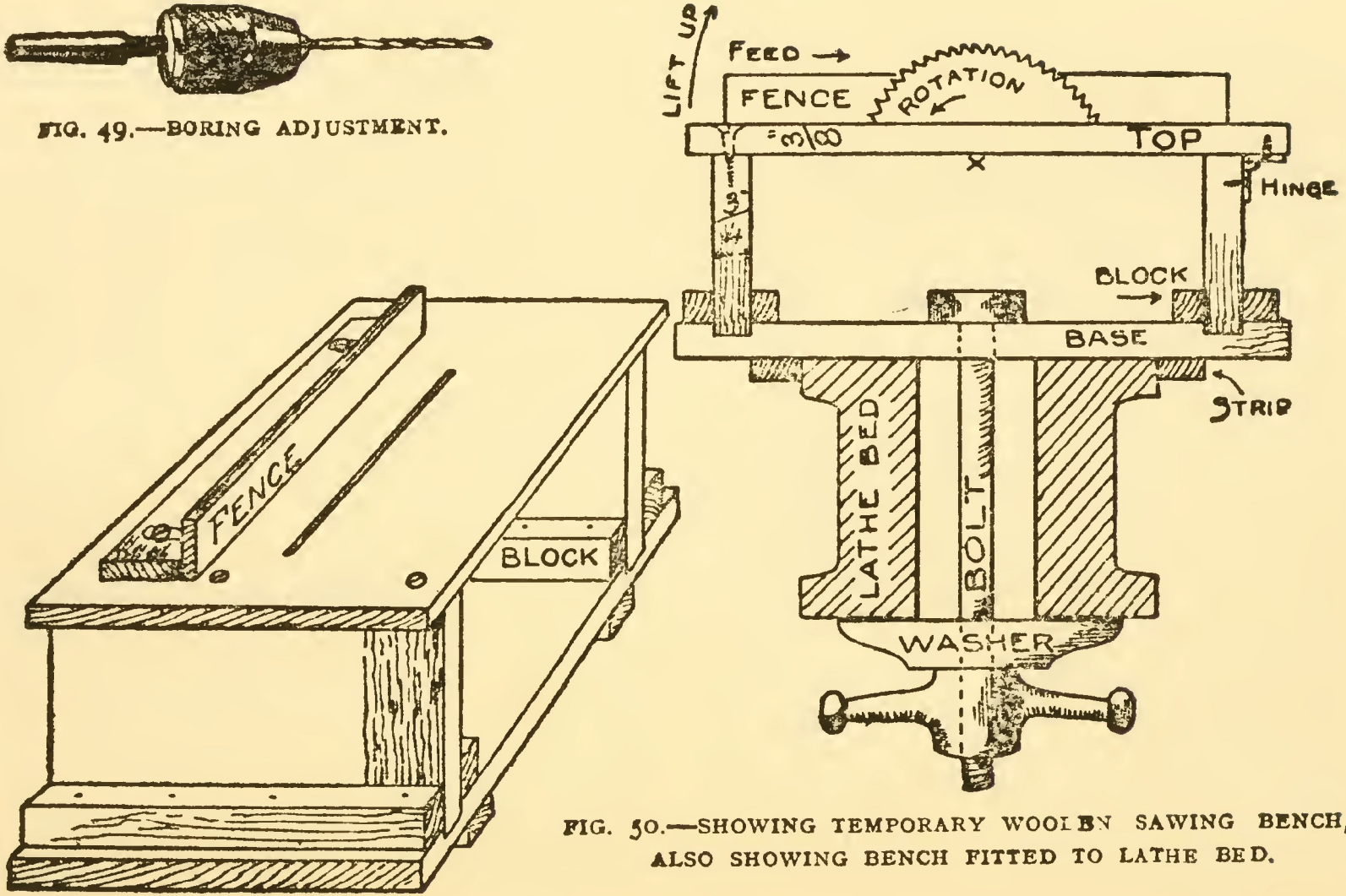


FIG. 50.—SHOWING TEMPORARY WOODEN SAWING BENCH, ALSO SHOWING BENCH FITTED TO LATHE BED.

lathe ; and, whilst admitting that the saw speed is not all that can be desired, the fact still remains that the amateur may obtain a great amount of useful work by such a combination. For a saw spindle the writer obtained a hub out of a bicycle wheel and turned down one end to a taper, so as to fit his lathe (Fig. 47). The saw spindle is fitted into the lathe as Fig. 48. The temporary saw bench is made of timber, so as to accommodate a circular saw of 4 ins. in diameter, having eight teeth to the inch.

A sketch of the temporary bench is illustrated at Fig. 50, and a side view of the bench fitted to the lathe bed is also given. The bench top is hinged at the right-hand end (Fig. 50) with a 3-in. brass butt hinge. This arrangement allows the left-hand end of the bench to be unscrewed, lifted up, and, by the use of a suitable strip of temporary packing, the top of the saw table may be adjusted to the desired height for rebating.

The writer has found the above appliance to answer splendidly for rebating the edge of door frames for light cabinet work, and he uses the strips which are cut away from the rebates to bead in door panels, etc.

The saw table is held in position with the same bolt and washer as is used to hold down the tool rest.

Sizes for this small sawing table cannot be given, because much will depend upon the size of the lathe centres and the width of the lathe bed and saw spindle. The approximate sizes are :—Length, 11 ins. ; and width, 5 ins. An adjustable fence may be made out of wood, $\frac{3}{8}$ in. in thickness, and this is secured by ordinary flat-headed screws, which fit in slots, as shown in Fig. 50.

Drilling Machine—By removing the dead centre A, Fig. 48, and substituting a three-jawed self-centreing chuck and boring bit, as at Fig. 49 (page 34), a really serviceable horizontal drilling machine for either wood or iron may be improvised. The necessary pressure to feed the wood or iron towards the drill is obtained by screwing up the hand-wheel at the end of the tail stock.

SPLIT TURNINGS, TURNED MOULDINGS, ETC.

REPRODUCTIONS of Jacobean furniture are at the present time so popular with the public that we may well devote a chapter to the making of split turnings. These are principally used for the ornamentation of pilasters and panels. Fig. 51 is a sketch of the pilaster of a fireplace jamb, and the enlarged drawing (Fig. 52, A) shows the detail of the split turning.

The simplest and most effective method of arriving at this result is as follows :—Take two pieces of timber, as shown at Fig. 53, and carefully plane them up so that, when placed together as at Fig. 54, they form a square when viewed at the end. Glue the two pieces together, with a piece of newspaper between them, and apply the necessary pressure so as to make a good joint by using one or more handscrews or cramps, as at Fig. 54. When the glue is set, mark out diagonal lines at each end, and carefully centre the work between the headstock and tailstock of the lathe, using, if possible, the type of live driving spur illustrated at Fig. 55. This spur, or driving centre, allows the work to be carefully centred up, and avoids any tendency to open up the glued joint.

The work is now turned to the desired shape, and, when finished, the two pieces of wood may be separated by sliding the thin blade of an ordinary table knife down the glued joint. The result will be that two split turnings are formed at one operation ; moreover, the back of each will be true and level, and will thus bed on to the face of the pilaster without the worker having to plane up the back of the turning.

To plane up the back of a split turning, especially if it has been sawn out of a solid piece of turnery, is an irritating and tedious job, even if the worker makes a

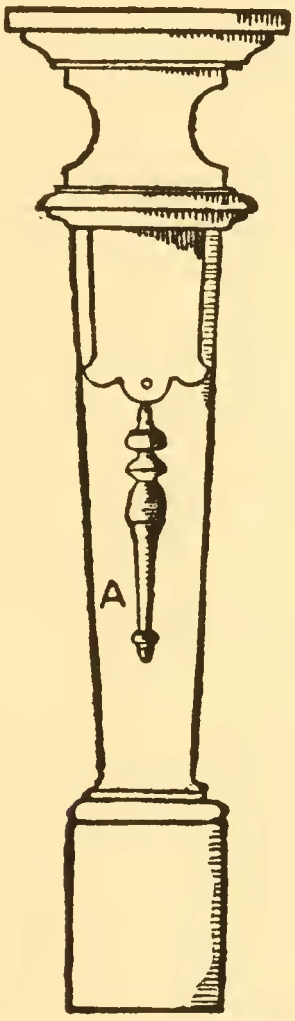


FIG. 51.—PILASTER WITH SPLIT TURNING.

FIG. 52.—DETAIL OF TURNING.

saddle or jig to hold the turning during the planing process, and the difficulty is increased if the split turning be of slender and delicate proportions.

Whether the split turnings be of large or small design the turner who has not access to a " dimension " saw

will be well advised to glue up his work in the manner described. Split turnings, such as pearl or fancy beadings, may be turned in this manner, no matter whether the section be a half or a quarter of a circle.

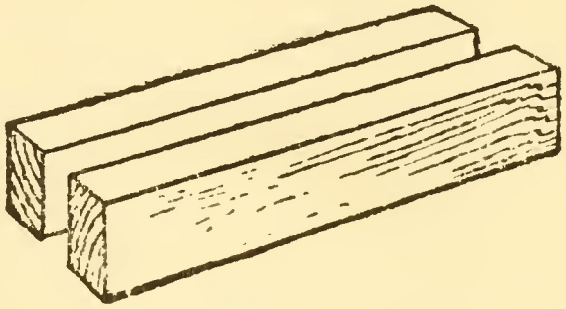


FIG. 53.—PREPARING THE WOOD.

Mouldings under sideboard tops and Continental clocks, etc., are frequently turned up in the lathe, and for the amateur who cannot work mouldings with a set of hollow and round planes much effective work may be added by using split mouldings.

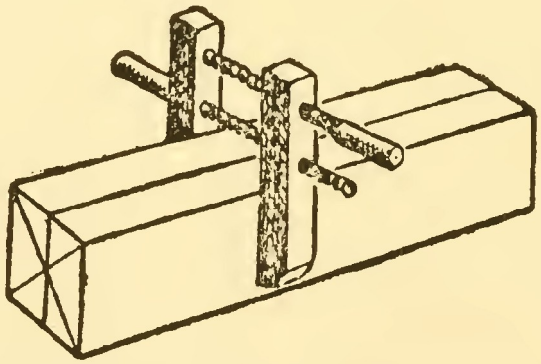


FIG. 54.—GLUEING THE WOOD.

At Fig. 56 is shown a turned beaded moulding under the top of a dressing-table. The beads (or mouldings) of these (see sections at Figs. 57 and 58) are turned in the lathe. The procedure is as follows :—The pieces which are to form the moulding are glued around a

square core of pine, as shown at Fig. 59; and it is essential that the core piece be planed up true and square, and that the outside pieces be thicknessed up before they are glued in their position with the pieces of paper separating the joints. The piece, Fig. 59, which should

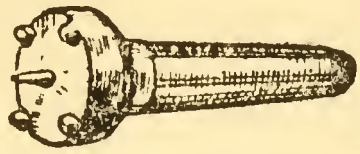


FIG. 55.—DRIVING SPUR.

be made as long as the bed of the lathe will permit, is now truly centred up, and, after being turned cylindrically, the beads or mouldings are turned upon it as indicated at Fig. 60. S shows where the turning will

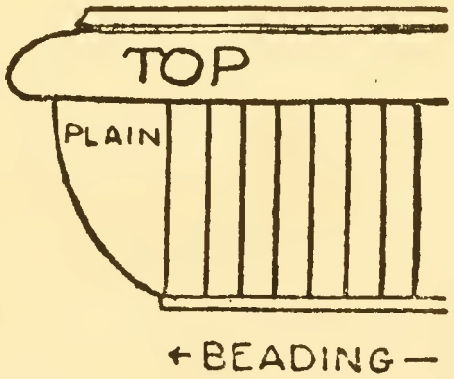


FIG. 56.—MITRED CORNER OF BEAD MOULDING.

be split with a knife blade, and, when the pieces are separated, it will give the worker four pieces similar to Fig. 62, which will be turned along their entire length with beads. These pieces are now permanently glued upon a pine backing, and their edges are planed away as shown at Fig. 61. The beaded moulding, if not of sufficient length to span from one end of the work to the

other, is butt-jointed, care being taken that the joint is at the juncture of two beads so as to hide the division. Some little difficulty often occurs with the mitreing of this type of moulding, especially when the length of the mitred moulding is not a multiple of the number of the

FIG. 57. FIG. 58.
SECTIONS OF BEAD MOULDINGS.

beads. To avoid this many Continental workers leave the mitred ends plain, as shown at Fig. 56 ; but some members make a more effective finish to this otherwise plain mitre by finishing it with acanthus leaf carving.

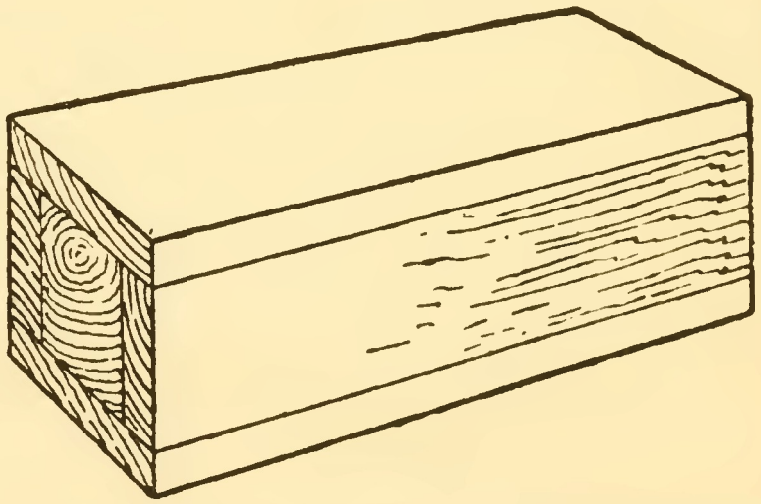


FIG. 59.—GLUEING UP THE PIECES ON A CENTRAL PIECE OF STOCK.

The Use of the Arbor.—An arbor may be described as a temporary piece of tapered steel or wood on which hollow articles are turned. Bobbin makers and others, who are constantly engaged upon hollow work, have specially long live spurs, which form a combined driving centre and arbor. The amateur, and frequently the

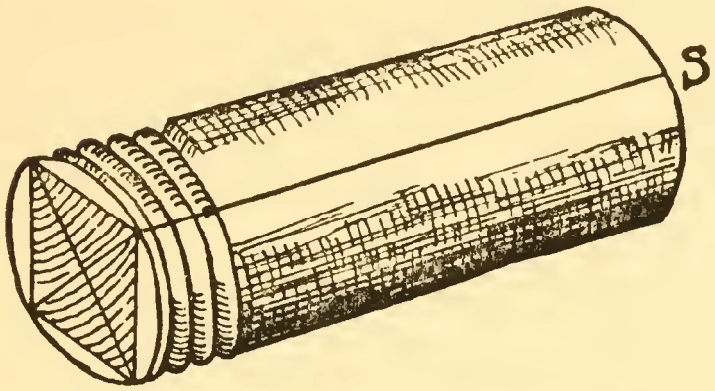


FIG. 60.—PREPARING WOOD FOR TURNED MOULDING.

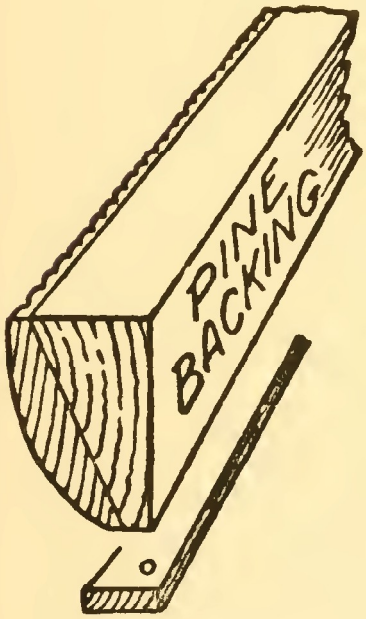


FIG. 61.—MOULDING BACKED.

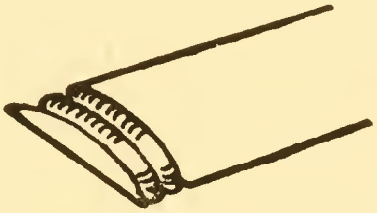


FIG. 62.—SPLIT MOULDING.

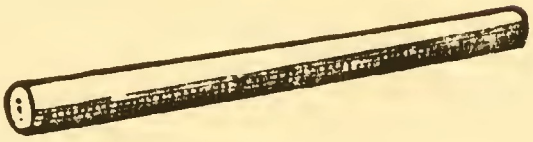


FIG. 63.—TEMPORARY WOODEN ARBOR.

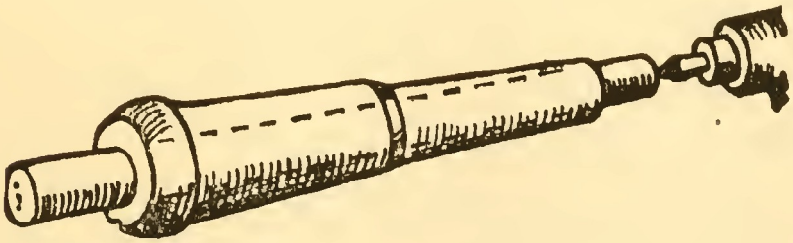


FIG. 64.—METHOD OF TURNING TOY CANNON.

trade turner, whose type of work is of an ever-varying nature, uses a temporary wooden arbor, which he makes specially for the particular job he may be engaged upon.

Fig. 63 illustrates a temporary wooden arbor, which consists of a piece of hardwood which has a slight taper

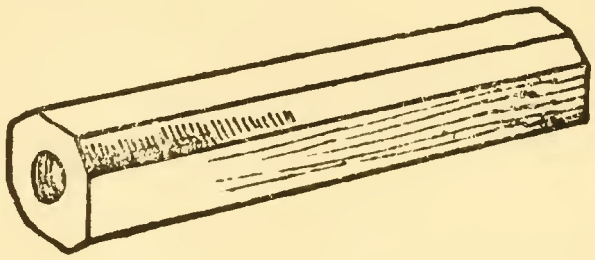


FIG. 65.—BORING WOOD TO MAKE AN ARBOR.

lengthways. Fig. 64 shows the method of turning up the barrel of a small wooden toy cannon, or other similar object, in which it is necessary that the inside and outside portions be concentric. The block of wood is first prepared by boring it lengthways with a twist bit, as

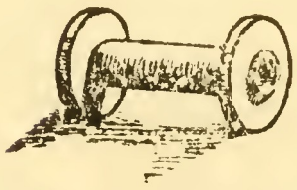


FIG. 66.—ELECTRICAL BOBBIN.

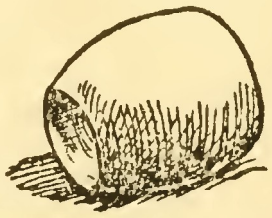


FIG. 67.—END OF VICE HANDLE.

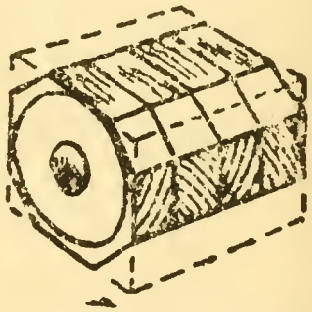


FIG. 68. — TURNING WHEELS.

shown at Fig. 65, after which it is pushed fairly tightly on to the arbor and placed between the lathe centres and turned up in the usual manner. If the object has any tendency to slip upon the arbor whilst the turning and shaping is in progress, slightly damp the arbor, and this will have the effect of raising the grain. Chalking has a similar effect.

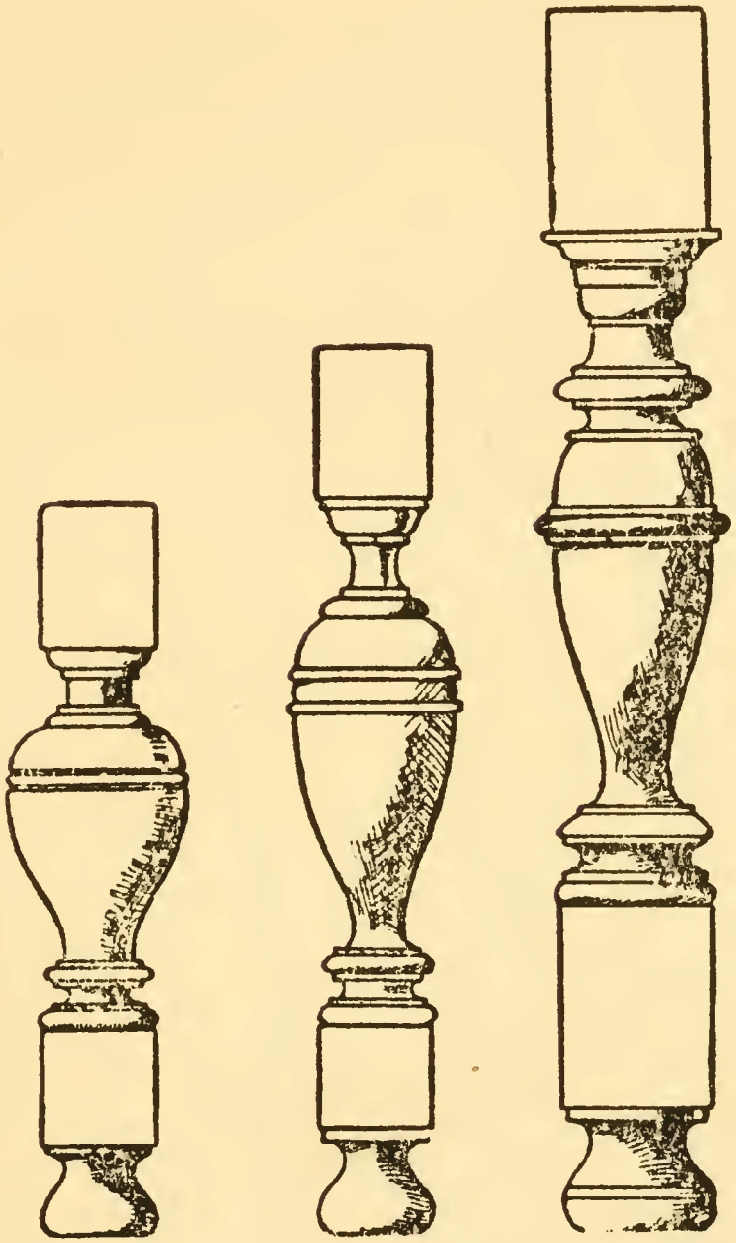


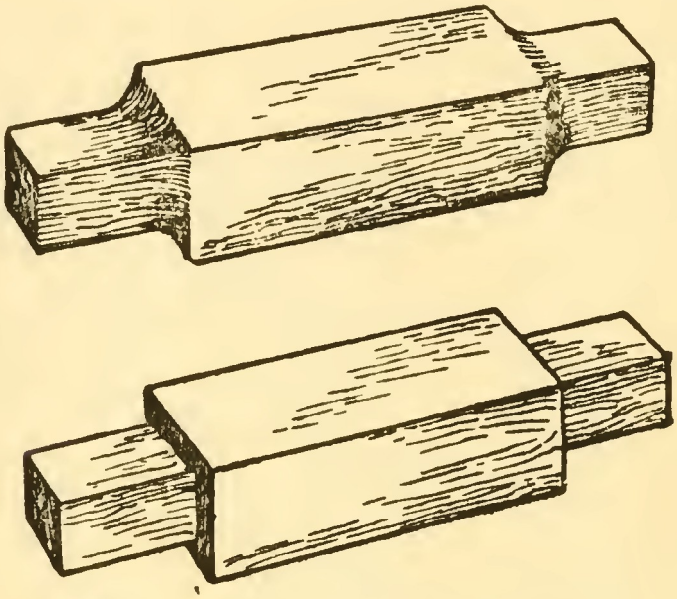
FIG. 69. FIG. 70. FIG. 71.

BULBOUS (OR ACORN-SHAPED) ELIZABETHAN AND JACOBEAN TURNINGS.

Small objects, such as the core bobbin for electrical work, Fig. 66, and the end piece for a wooden vice handle, Fig. 67, are ordinary examples of the class of work turned on an arbor.

Fig. 68 illustrates four pieces of wood which are glued

together with paper between the joints, ready to be placed on an arbor and turned to the required diameter for the wheels of a toy locomotive or similar article. The



FIGS. 72, 73.—REDUCED SQUARES.

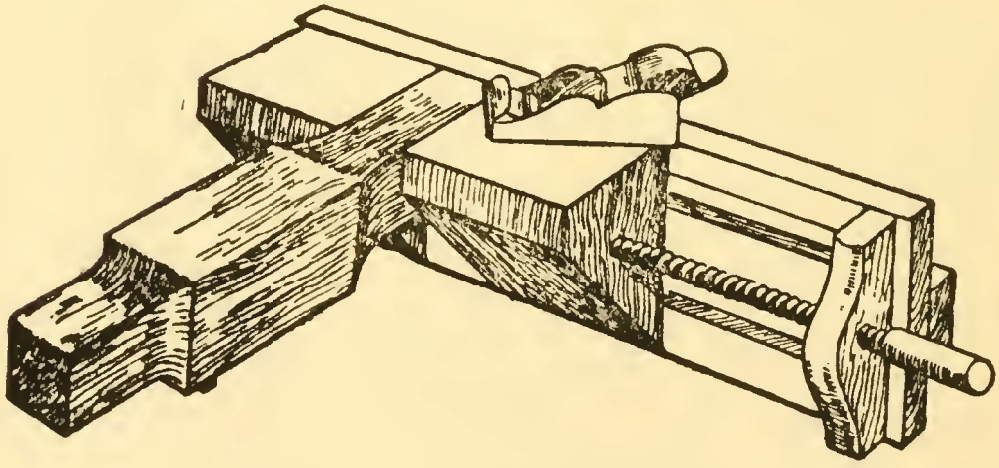


FIG. 74.—PLANING UP THE SQUARES OF REDUCED TURNINGS. (THE WOOD IS HELD IN THE MITRE TRAP.)

wheels are then split asunder, the separations being at the positions where the paper was glued. If wheels are not required to have the grain of the wood running

in the direction shown, it is, of course, only necessary to turn up a cylindrical piece and separate it into the required number of pieces with the parting tool.

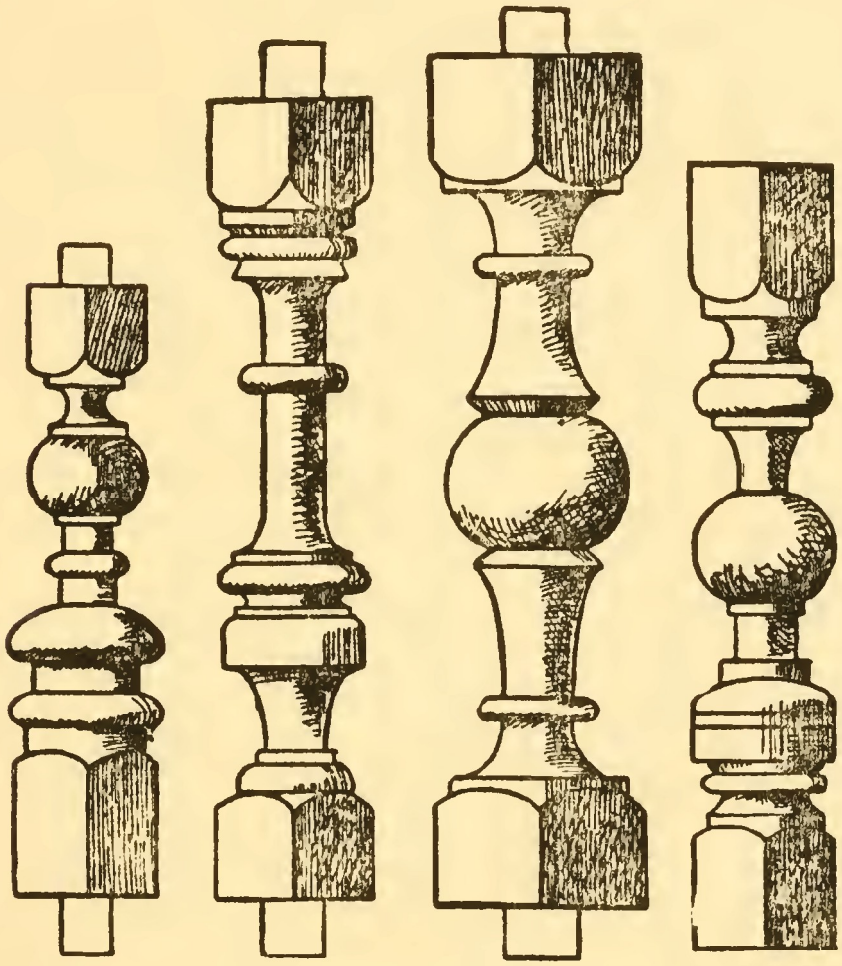


FIG. 75. FIG. 76. FIG. 77. FIG. 78.
EXAMPLES OF TURNED PILLARS FOR GATES, RAILINGS, BALUSTERS, ETC.

Elizabethan and Jacobean Turnings.—The type of leg used during the Elizabethan and Jacobean periods was similar to the illustrations at Figs. 69, 70, and 71; the turning is swollen at the centre, and frequently referred to as " bulbous " or " acorn " tuning.

It will be noticed that the turned portion at the centre

is of a much greater measurement than the squares which form the top and bottom of the leg. When reproducing this kind of turning, which is generally known as " turnings with reduced squares," it is usual to work away the material at the top and bottom of the leg prior to the timber being put into the lathe. The squares may be reduced by planing them on a power-driven " hand feed " surfacing machine, which gives the result shown at Fig. 72 ; or they may be sawn down with a hand saw, which leaves them as shown at Fig. 73.

If the sawing be accomplished by hand the work will have to be fixed in the mitre shooting trap, and the squares will have to be brought to a finish by planing them with a small plane, such as a chariot plane, shown at Fig. 74.

Figs. 75, 76, 77, and 78 illustrate good examples of turned pillars suitable for garden gates, garden railings, balusters, and general work.

When work has to be produced at a low price, four pieces of wood are glued around the timber so as to build up the work. This plan should only be resorted to when the joint lines can be hidden, say, by carving; even then the built-up work cannot be compared with a solid leg.

TWISTED AND SPIRAL TURNINGS

TWISTED turnings are of three distinct types, and these are again sub-divided into decorated spirals. There is the single twist, the double twist, and the triple twist, and work of this class is looked upon by most amateurs as something in the nature of a mystery. In up-to-date factories twisted turnings are worked on a special type of lathe, designed similarly to an engineer's screw-cutting lathe; in this chapter, however, we shall confine our remarks

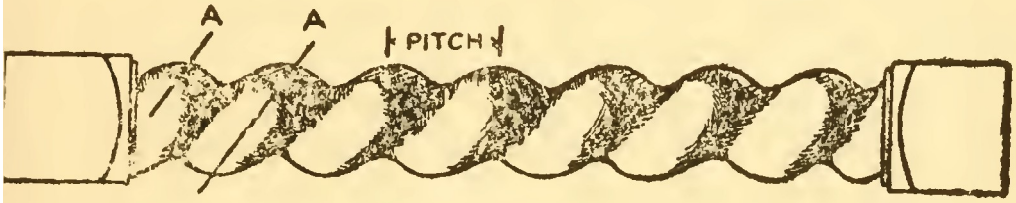


FIG. 79.—SINGLE TWIST TURNING, SHOWING "PITCH."

to the methods used by the old craftsmen who made twisted turnings long before the introduction of modern wood-working machinery.

Single Twists.—First of all we shall consider the marking out and the cutting of a single twist as illustrated at Fig. 79. The distance travelled by a screw in one revolution through the nut is called the "pitch" (see Fig. 79), so that, after having turned the work cylindrical, the worker will have to decide what pitch he will use for his twisted turning. Fig. 79 is 1 in. in diameter, and it has a pitch of 1 in. Generally speaking, the pitch is equal to the diameter when working an example similar to the one shown.

To Mark Out the Work, divide the circumference of the cylindrical portion into four equal parts, and

draw lines lengthways down the cylinder, as at Fig. 80. These lines may be drawn by using a pencil and ruler.

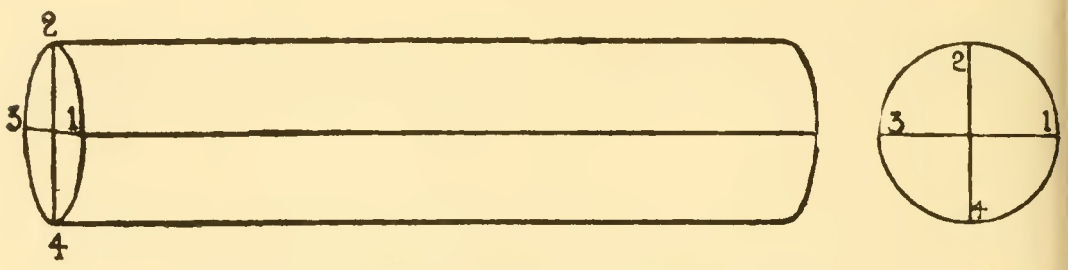


FIG. 80.—FIRST STAGE IN MARKING OUT.

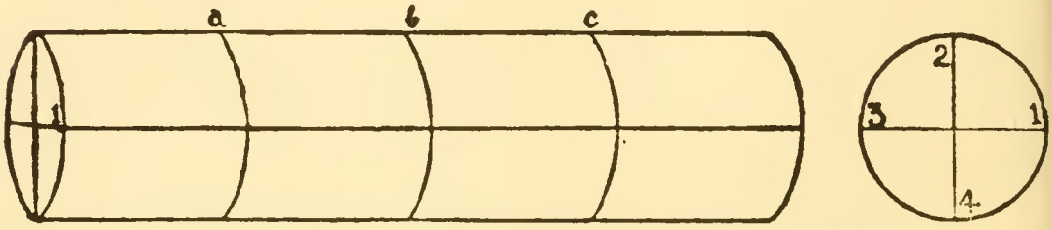


FIG. 81.—SECOND STAGE IN MARKING OUT.

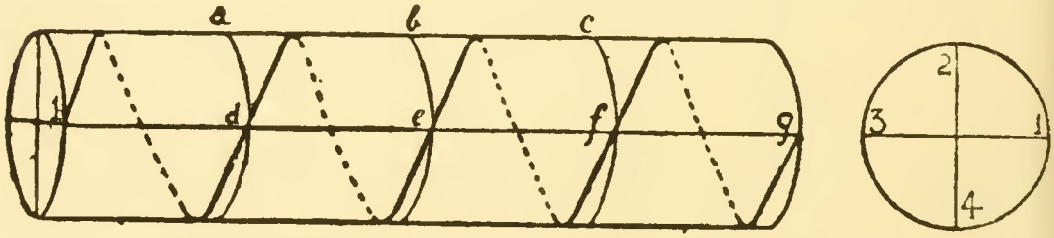


FIG. 82.—THIRD STAGE IN MARKING OUT.

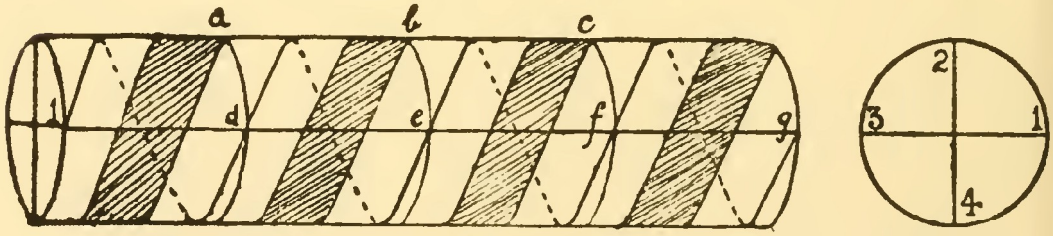


FIG. 83.—SINGLE TWIST MARKED OUT. SHADED PORTION WILL BECOME THE HOLLOW.

Put the work into the lathe and set it revolving. Whilst it is revolving mark lines with a pencil which are spaced 1 in. apart as illustrated at Fig. 81. The worker is

advised to use a blue pencil for this purpose, so as to avoid confusion later on. When these lines have been drawn around the work, take it out of the lathe and draw a spiral line (Fig. 82) from 1 through *d*; through *e*; through *f*; and on to *g*. This line may be drawn freehand; or, better still, make a strip of thin cardboard and fold it around the cylinder so that its edge runs through the above-mentioned points 1, *d*, *e*, *f*, *g*. Then, holding the cardboard in position, run your pencil along the top edge, and it will neatly mark a spiral line which will run through the desired points of intersection.

This spiral line, which is shown at Fig. 82, is the line A A shown on the finished sketch, Fig. 79; in other words, it is the spiral line at the top of the round portion of the twist.

The next step is to divide the distances 1 to *d*; *d* to *e*; *e* to *f*; and *f* to *g* (Fig. 82) into three equal portions, as at Fig. 83. The shaded portion shown in this sketch will eventually be cut away to form the hollow portion of the spiral.

After the marking out is completed, the work is again placed between the lathe centres, and the driving strap is thrown off the pulley. Hold the pulley or the work with the left hand, and with a tenon saw cut a vee notch down the work, as at Fig. 84. First use the tenon saw, cutting to the right; then use it cutting towards the left; the work meanwhile being rotated slowly with the left hand. This will remove the superfluous timber and leave a roughly-cut vee notch which will, later on, form the hollow of the twist.

Take a $\frac{1}{2}$-in. chisel, as at Fig. 85, and by paring away the wood it will round the timber as shown. After this the hollow portion is eased out with a suitable gouge ($\frac{3}{8}$-in. or $\frac{1}{2}$-in.), and the hollow portion is filed up with a $\frac{1}{2}$-in. rat-tailed file. The work is slowly revolved with the left hand during this filing process, and eventually it is completed by glass-papering the whole of the

piece. The beginner should make his first experiment with a single twist; and, after becoming conversant with the method of working, he should then set out and cut a double twist.

Double Twist.—Fig. 86 shows a double twist, marked out and in the lathe ready for cutting. Fig. 84

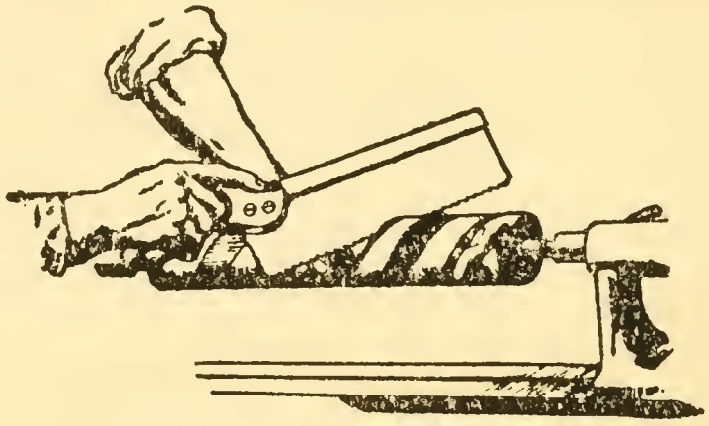


FIG. 84.—CUTTING THE NOTCH.

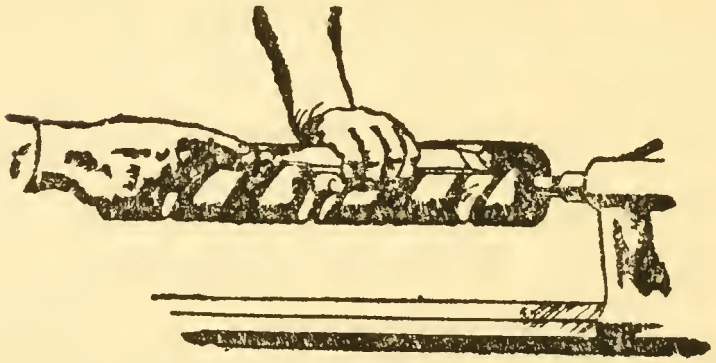


FIG. 85.—PARING AND ROUNDING OVER THE TWIST.

illustrates the method of sawing away the waste material. Fig. 87 shows one hollow spiral of the double twist roughly sawn away; and after this step it is, of course, necessary to saw away the waste material from the other hollow spiral, which is shown shaded in this illustration, so as not to confuse the worker. Fig. 88 shows the double twist when finished.

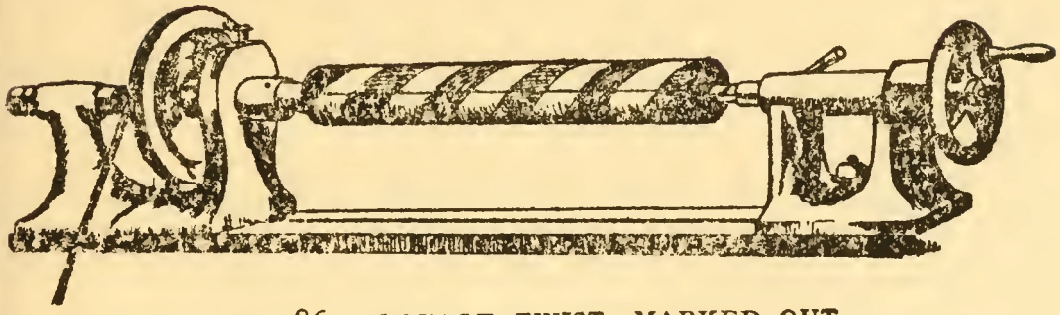


FIG. 86.—DOUBLE TWIST, MARKED OUT.

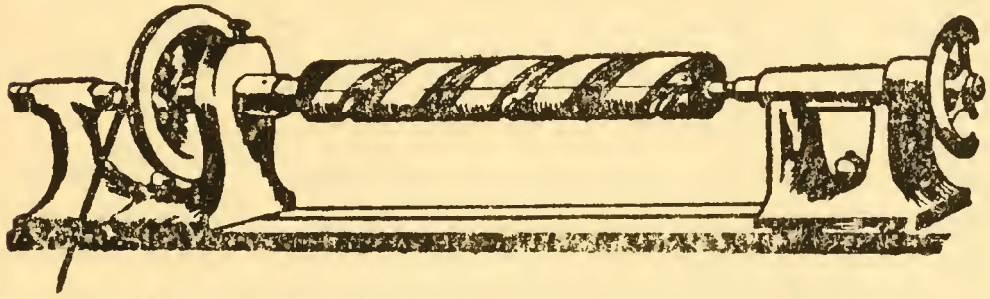


FIG. 87.—ONE PORTION OF A DOUBLE TWIST ROUGHLY SAWN.

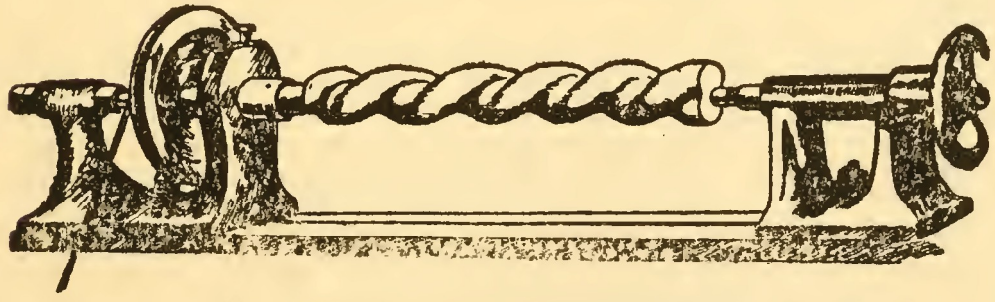


FIG. 88.—DOUBLE TWIST FINISHED.

Occasionally the worker is required to produce a double-twisted turning in which the strands are separated, as at Fig. 89. When this is the case, the

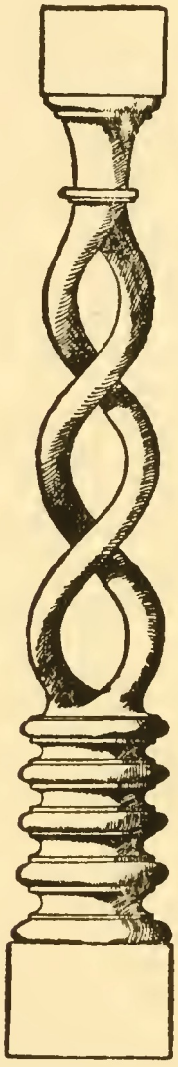


FIG. 89.—DOUBLE TWIST. SEPARATE STRANDS.

FIG. 90.—TRIPLE TWIST, WITH SEPARATE STRANDS.

double twist is finished similar to that shown at Fig. 88; after which a series of holes is bored through the hollow portions with a twist-bit, as shown at Fig. 91. The work is then pared up so as to separate the strands, and

filed and glass-papered to a finish. Fig. 89 shows a double twist with the strands separated.

Triple-twisted Turning. — Fig. 90 illustrates a tapered twisted turning having three strands, which are separated. This, of course, is the most difficult and the most effective type of twisted work. To mark out

FIG. 91.—DOUBLE TWIST, BORED AND READY FOR SEPARATING.

a three-strand twist the cylinder is trisected lengthways instead of dividing it into four equal portions, as was shown at Fig. 81.

If the beginner finds any difficulty in setting out a spiral, he may make use of the following method. Cut a strip of paper about 1 in. wide and, say, 2 ft. long.

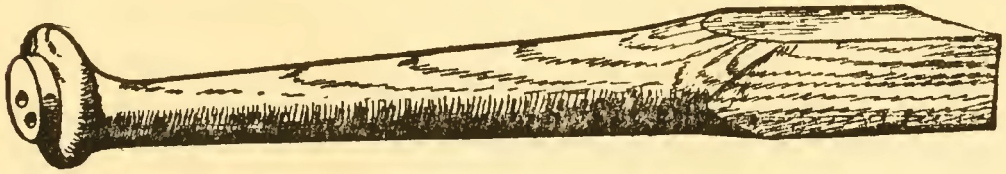


FIG. 92.—EXAMPLE OF CHAIR LEG, WITH CLUB FOOT.

Glue or paste one side of the paper and wind it around the cylinder similar to a barber's pole, the paper, of course, being laid on the wood evenly, and without puckers or blisters. The portions of the work not covered by the strip of paper should be cut away and finished as previously described.

Turning Clubbed Foot Legs.—Chair legs having club feet, as shown at Fig. 92, are turned up on two centres ; that is, they are first turned up in the ordinary way by using the true centres. After this operation, the

centre at the toe is moved about a ¼ or ⅜ in. as occasion demands, and the foot is then turned up again, thus giving it the appearance shown in the sketch. The

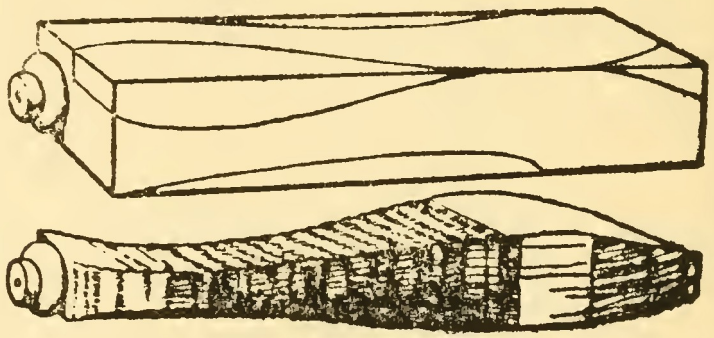


FIG. 93.—CABRIOLE LEG MARKED OUT.

FIG. 94.—CABRIOLE LEG SAWN.

centre at the top of the leg is not altered during the turning process.

Queen Anne and Cabriole Legs.—The toes of Queen Anne and cabriole legs are generally turned in the lathe, as this method gives a guide to the work

FIG. 95.—CABRIOLE LEG FINISHED.

generally. Fig. 93 shows a block of wood on which the toe portion has been turned and the square portion marked out for sawing. Note that the toe portion can only be turned until it reaches the highest point of the diameter of the toe, as shown in the sketch. The leg portion is now sawn away square, as shown at Fig. 94; and after this the work is brought to a finish by using the chisel, the spokeshave, the file, and glass-paper, as at Fig. 95.

CHUCKS, FACE PLATES, ETC.

CHUCKS are appliances which are used to hold the timber securely and firmly on to the lathe mandrel. At Fig. 96 the headstock of the lathe is shown, with the metal chuck (A) unscrewed. Immediately to the right-hand of A is illustrated the tapered steel prong or fork which holds the work.

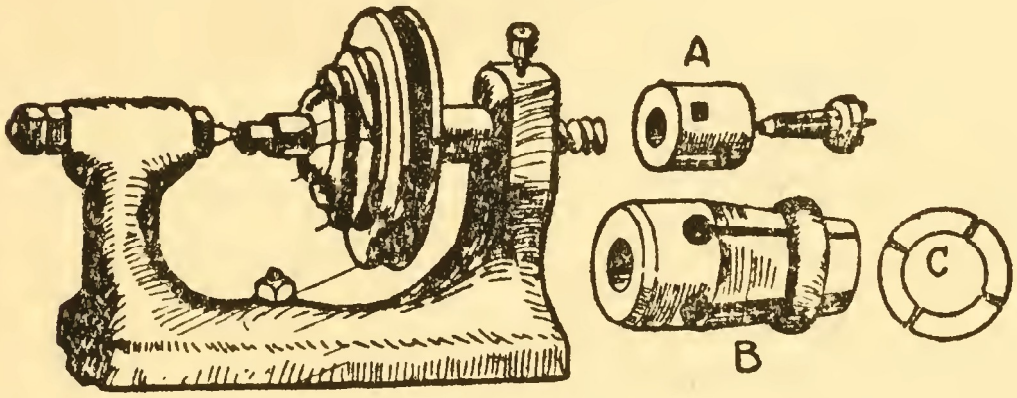


FIG. 96.—HEADSTOCK OF LATHE: A, METAL CHUCK; B, WOODEN SPLIT CHUCK; C, END VIEW OF B.

The chuck (A) is generally supplied with the lathe and it may be used for many other purposes besides holding the tapered prong which is shown. For instance, at Fig. 97, we show a small ornament which is turned down by supporting the timber at one end only, the tailstock of the lathe being dispensed with for this particular purpose. The piece of wood is pared, or turned down, so that one end of it may be driven tightly into the chuck (A, Fig. 96). The timber is thus held by friction, whilst the ornament is turned up and finished.

Split Chuck.—Another type of home-made wooden chuck, called a split chuck, is shown at Fig. 96, B. It is necessary to use suitable wood for chucks of this type, or they will not wear well. Sycamore and plane tree

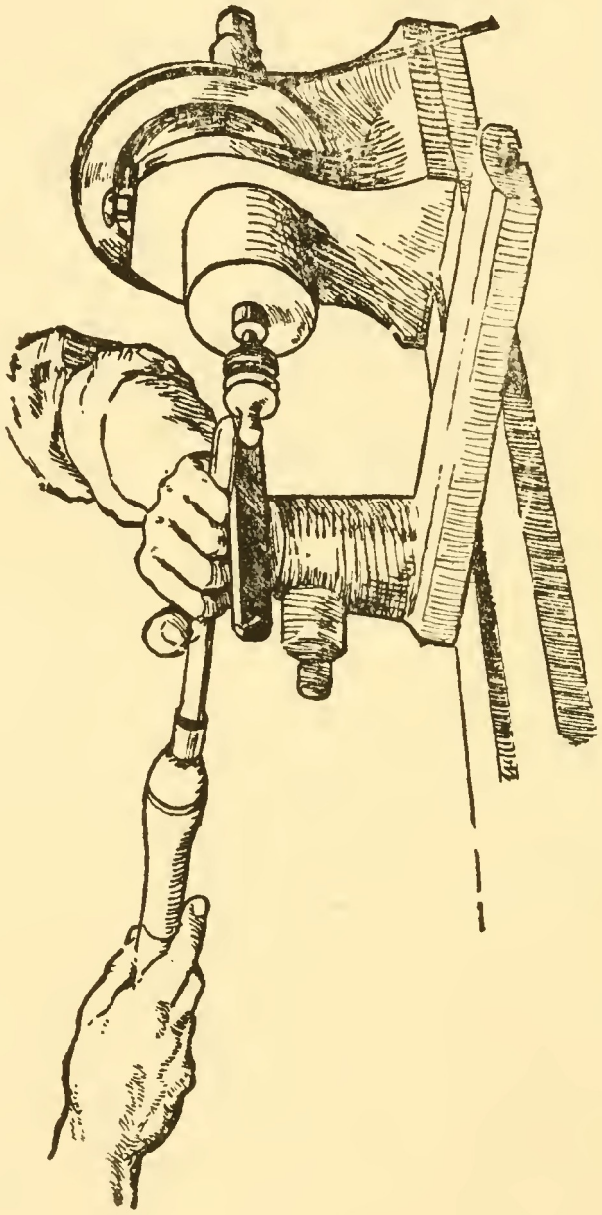


FIG. 97.—TURNING AN ORNAMENT SUPPORTED AT ONE END ONLY.

are fairly tough and hard, whilst not liable to spring and twist. Failing these, a good tough piece of bass wood will make a good substitute. Beech is often recommended, but is really unsuitable, being too hard for the metal thread to cut into it. Boxwood is also a suitable material, but the above objection also applies here. A very good method, especially with the harder woods, is to bore a suitable hole and work the ordinary metal tap into it, so as to cut the thread in exactly the same manner as is used when tapping a metal thread. The thread should be cut into the blocks,

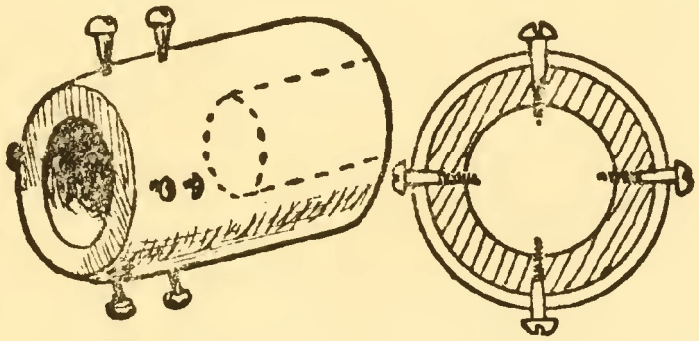


FIG. 98.—HOME-MADE SCREW CHUCK.

end way of the grain, and, as a rule, the wood should be used that way of the grain.

Home-made wooden chucks are, of course, not to be compared with metal ones; but for the beginner they will answer all purposes, and, if used with care, they will wear for many years.

The Split Chuck at Fig. 96, B (of which the end view is shown at C), is made as follows:—Take a piece of wood, about 3 ins. long by 2¼ ins. square; bore a hole in one end of the wood and work a thread in it, so that it will screw tightly on to the nose of the mandrel. Before it is screwed quite home the end of the wood must be turned true, and it may with advantage be

turned slightly concave, so that it beds truly on its outside edge against the shoulder of the mandrel. The block is now screwed tightly on the mandrel, and is turned up truly to the shape shown at Fig. 96, B. The recess C (Fig. 96) is then turned out to a suitable diameter, say, 1 in., or in accordance with the diameter of the work which it is intended to hold. The chuck must now be removed from the lathe, and the front end is slotted down with a tenon saw, the cuts being made at right angles. Four $\frac{3}{8}$-in. holes may be bored at the

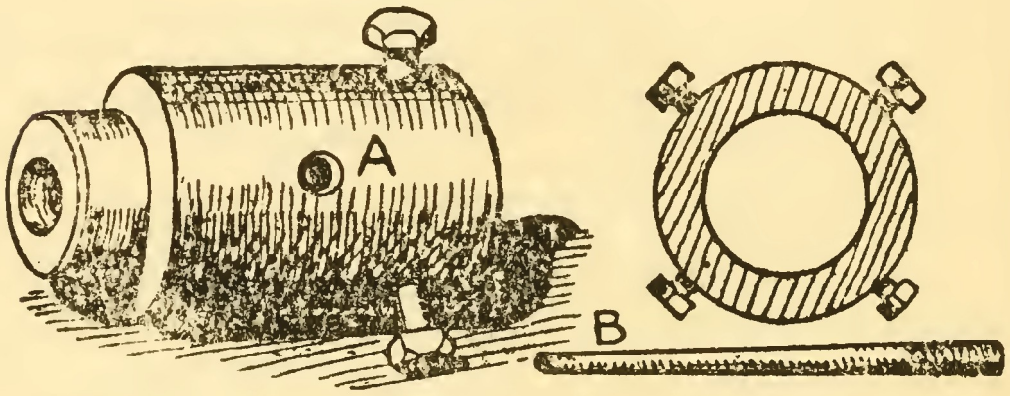


FIG. 99.—METAL CHUCK: A, HOLE; B, TOMMY BAR. END VIEW ALSO SHOWN.

bottom of the saw kerfs, so as to allow the chuck to open slightly when the wood is forced in position. Thus they cause the wood which is to be turned to be gripped equally all round and held very tightly. A brass or iron ring is now driven on to the chuck so as to compress the four jaws, and thus hold the work securely.

The Screw Chuck.—Fig. 98 shows a wooden chuck made similarly to the previous one; but, instead of making saw cuts, two rows of round-headed screws are inserted. The points of these screws must be filed off, otherwise they will damage the work. This chuck is a most useful one, allowing the work to be mounted

either centrally or eccentrically. Chucks of this type are made in different sizes as occasion demands.

Fig. 99 illustrates a similar type of metal chuck which may be bought from the maker of the lathe. A shows the hole, and B illustrates the tommy-bar, which is supplied so as to facilitate the screwing and unscrewing of the chuck on the lathe mandrel.

Fig. 100 is a section of a screw chuck which is most useful when a metal face plate is not supplied with the

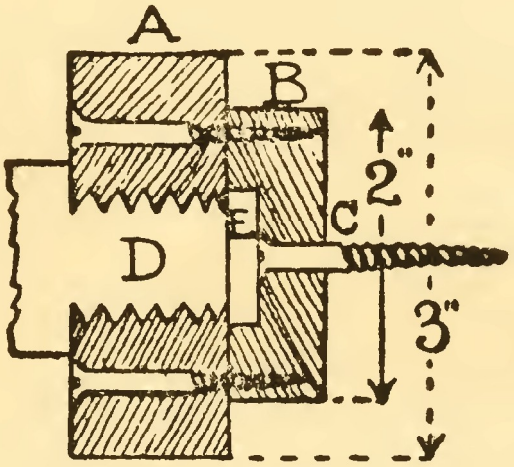


FIG. 100.—SECTION OF SCREW CHUCK, SUITABLE FOR USING WHEN LATHE HAS NO FACE PLATE.

lathe. The piece of hardwood (A) is first turned up, and the centre hole is turned out to fit the diameter of the thread that is on the mandrel. The face of the block (A) is then turned up truly. The block is now removed from the lathe, and piece B is turned up and glued and screwed upon the face of A. The work is next placed upon the mandrel, and the whole of the block is turned up truly on its outside edges. A temporary small face plate or simple screw chuck is thus evolved. E is the recess at the back of piece B ; and C is a good stout gauge screw which holds the wood to the surface of the chuck.

Face Plates.—Fig. 101 illustrates the type of cast-iron face plate, generally about 9 ins. in diameter, which is supplied by the maker; A is the front view, B the back view, and C shows the front view after the worker has bolted on a 1-in. piece of wood and fitted a suitable centre screw, as described in the case of Fig. 100. The object of fixing a piece of wood on the face of this plate is to prevent the worker from allowing his turning tool to come in contact with the metal, and thus necessitate frequent grinding and sharpening.

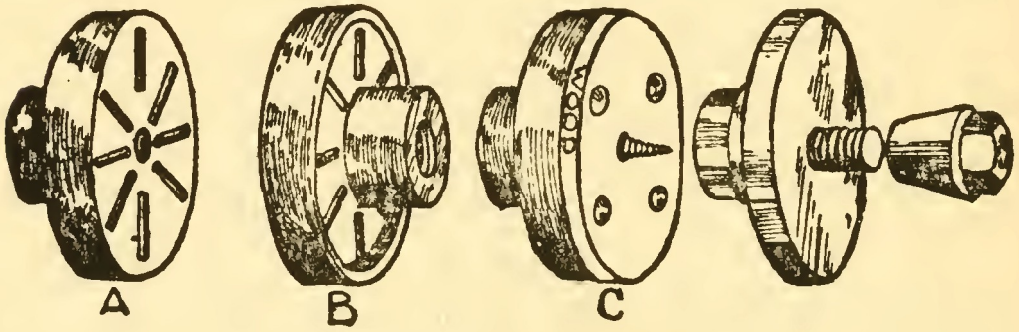


FIG. 101.—FACE PLATE: A, FRONT VIEW; B, BACK VIEW; C, FRONT VIEW WITH WOOD FACE.

FIG. 102.—CHUCK FOR TURNING DISCS.

Fig. 102 is a chuck for turning discs which have a central hole in them. The discs are first bored to slip over the screwed portion of the chuck. The conical shaped piece of boxwood which has a hole bored through its centre is forced into the hole of the disc by the nut shown in the illustration, thus giving sufficient pressure, and at the same time ensuring that the disc be mounted centrally upon the lathe.

Fig. 103 gives a sketch and section of the face plate shown at Fig. 101, which has been fitted with a wooden cover, in the centre of which a square hole has been cut. The object of this appliance is to accommodate square legs to engage with the chuck, so as to avoid waste of

time in centreing up a quantity of square stock which has to be turned into table legs or spindles. The square

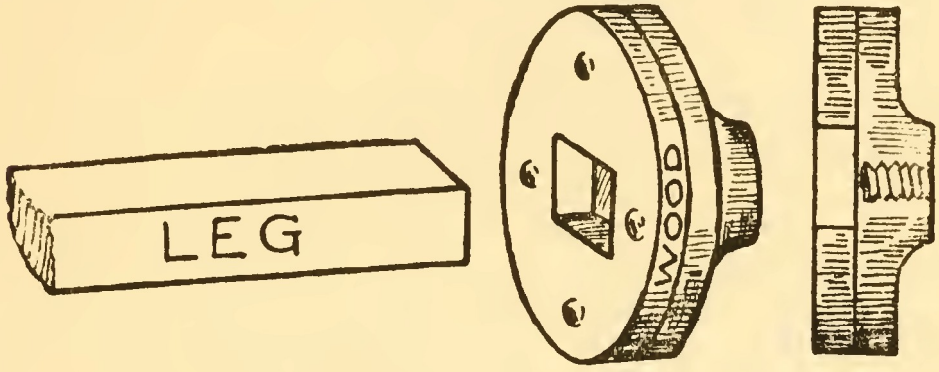


FIG. 103.—FACE PLATE TO TAKE SQUARE TIMBER.

of the leg is simply placed in the recess, and the tail stock is screwed up in the usual manner.

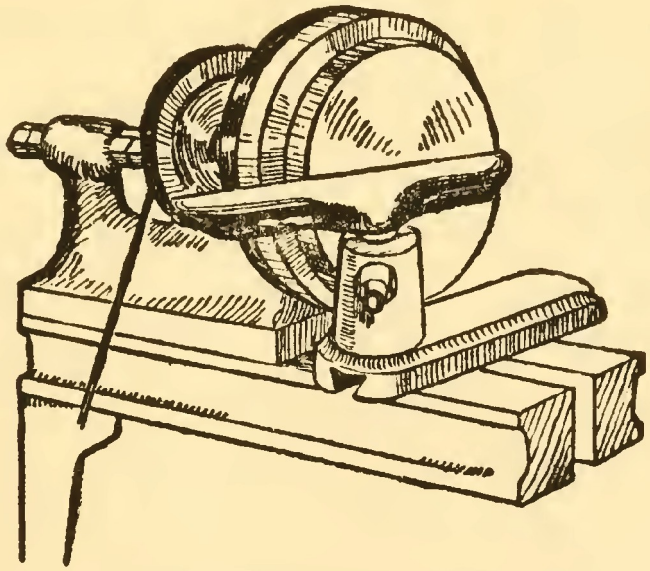


FIG. 104.—WORK MOUNTED ON FACE PLATE WITH THE REST IN POSITION.

At Fig. 104 is shown a piece of wood mounted on the face plate, and the rest is shown set at right-angles to the work ready for the turning up process.

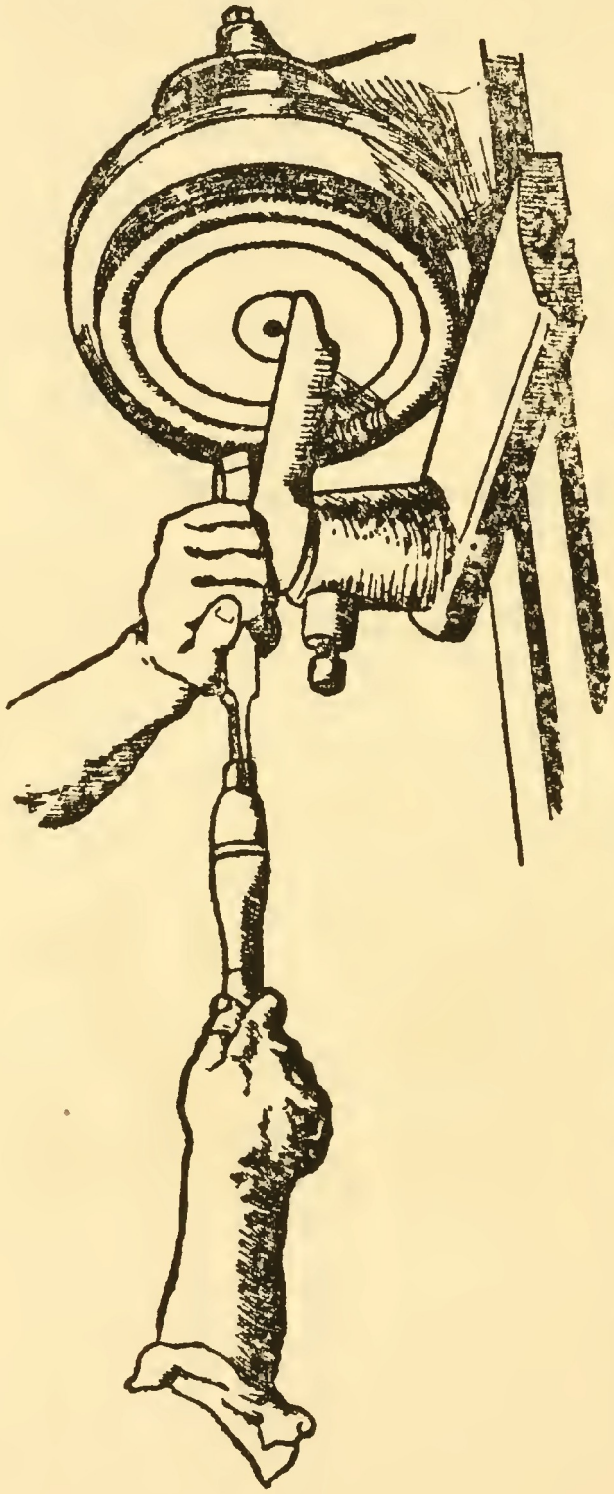


FIG. 105.—CUTTING DOWN THE EDGE OF A TURNED PATERA WITH TURNING CHISEL.

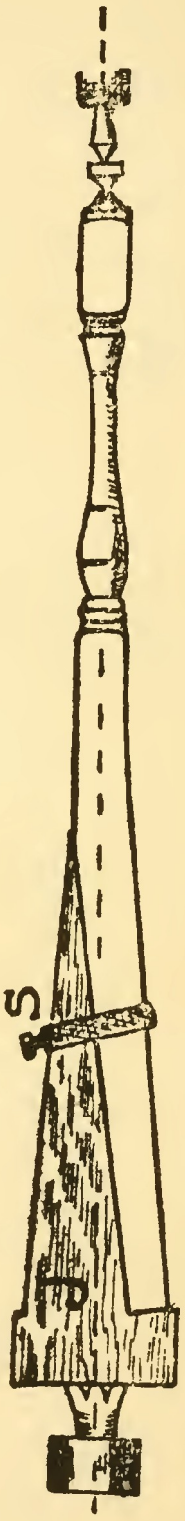


FIG. 106.—HOW TO TURN UPPER PART OF BACK LEG OF CHAIR: J, JIG; S, METAL STRAP.

The use of the turning chisel for cutting down and finishing the edge of the disc is suggested at Fig. 105, whilst at Fig 108 the same tool is shown sinking a central recess.

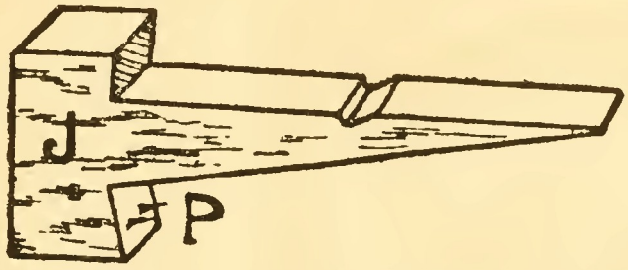


FIG. 107.—SKETCH OF JIG REQUIRED FOR TURNING UPPER PART OF BACK LEG OF CHAIR (SEE FIG. 106).

Turning Shaped Chair Leg.—A specimen of work which is often somewhat of a mystery to the amateur turner is given at Fig. 106. A shaped back leg of a

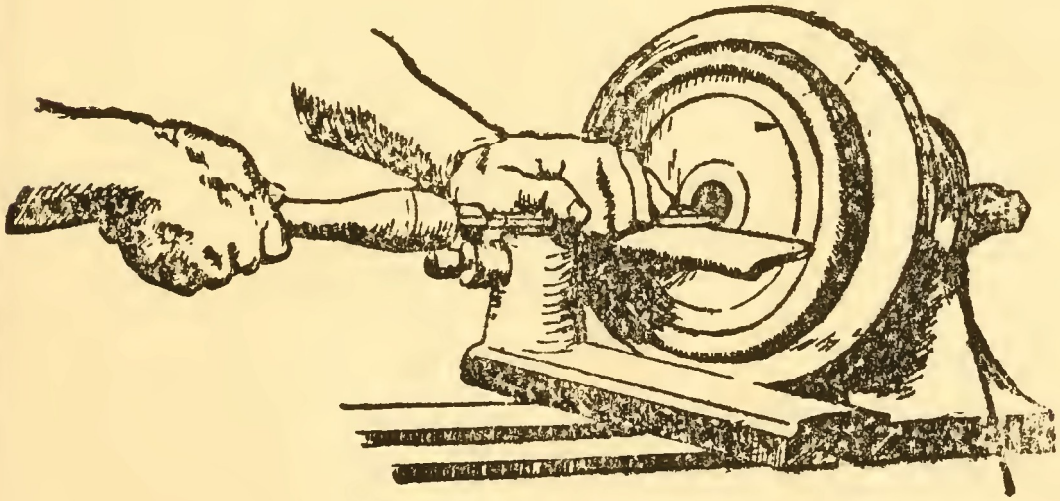


FIG. 108.—SINKING RECESS IN TURNED PATERA.

chair is shown, and it is desired to turn the upper portion into a spindle having a finial at the end of it. This leg is carried in a jig or saddle, so that the axis is central. J shows the jig, or saddle, and S is the metal strap that is temporarily used to hold the work together. Fig. 107

is a sketch of the jig. At P two screws, 1½ ins. long, have been screwed into the jig, with their heads filed off to resemble nail points. The chair leg receives these points at the foot, and the strap (S) holds all securely

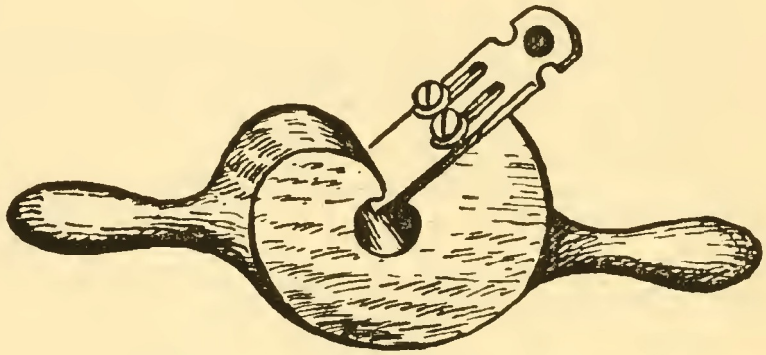


FIG. 109.—A ROUNDING TOOL.

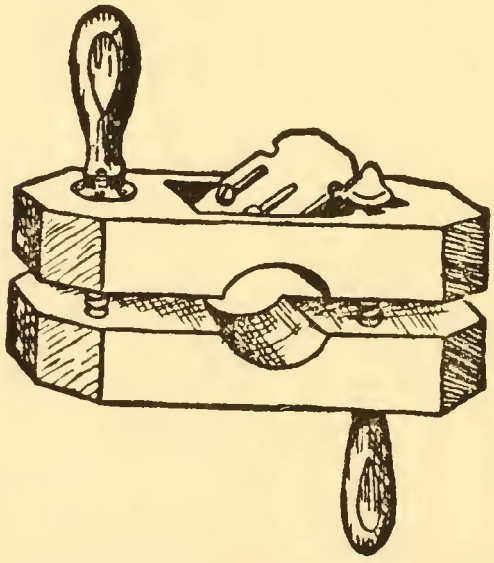


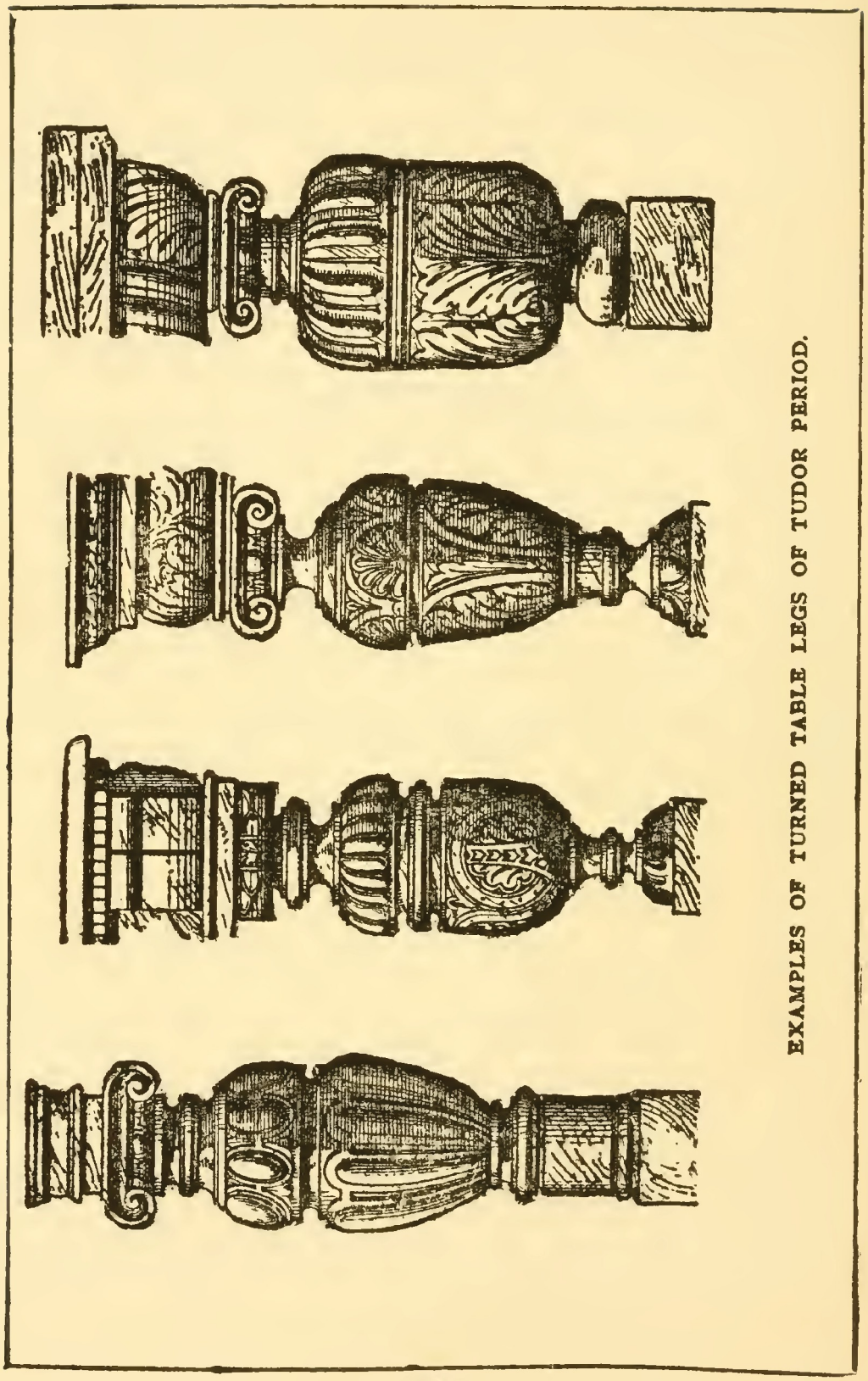
FIG. 110.—ANOTHER TYPE OF ROUNDING TOOL.

together. Some workers prefer to make the lower portion of the jig into box form, so that the leg snugly fits inside it. Care must be taken in this class of work that the jig be made so as to give a true running balance, and the same weight of timber must be left above the

axis (Fig. 106) as there is below; otherwise vibration and consequent bad work will be the result.

Suggestions such as the above will enable any ingenious worker to carry out much that at first sight appears almost impossible to manipulate in the wood-turning lathe.

Rounding Tools.—At Figs. 109 and 110 two distinct types of rounding tools are shown, such as are used for the rounding of broomstick handles, blind rollers, etc. This type of tool may be used with or without a lathe, and this is probably the line of demarcation between rounding with hand tools and rounding in the lathe. The square sticks may be roughed down with the gouge whilst the lathe is revolving, after which the tailstock is slackened and the rounding tool is slipped over the dead centre. The tailstock is then screwed up and the work is revolved in the lathe, whilst the rounding tool is pushed by hand towards the lathe headstock. When using this class of rounding tool without the lathe, the work has the corners chamfered away so as to form an octagon; the work is then secured in the vice, and the rounding tool is rotated by hand.



EXAMPLES OF TURNED TABLE LEGS OF TUDOR PERIOD.

HOLLOWING A VASE—SUPPORTING COLLARS—TURNED MOULDS

HOLLOWING.—Possibly one of the most difficult kinds of work for the beginner to tackle is hollowing on the face plate. At Fig. 111 is given a sketch and dimensioned drawing of a hollow wooden vase, which may be used as a receptacle for holding safety pins, studs, buttons and similar objects. The vase shown was made up in olive wood, but any hard wood, such as ash, oak, or beech will answer.

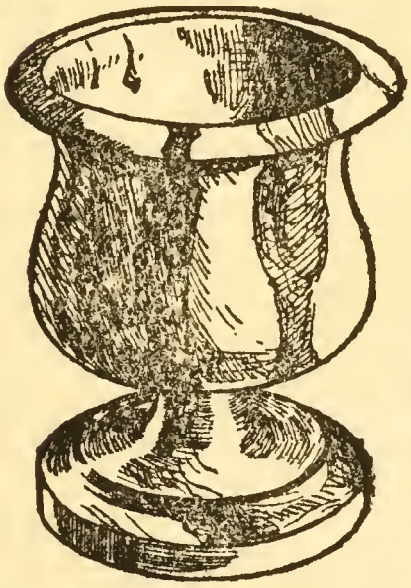
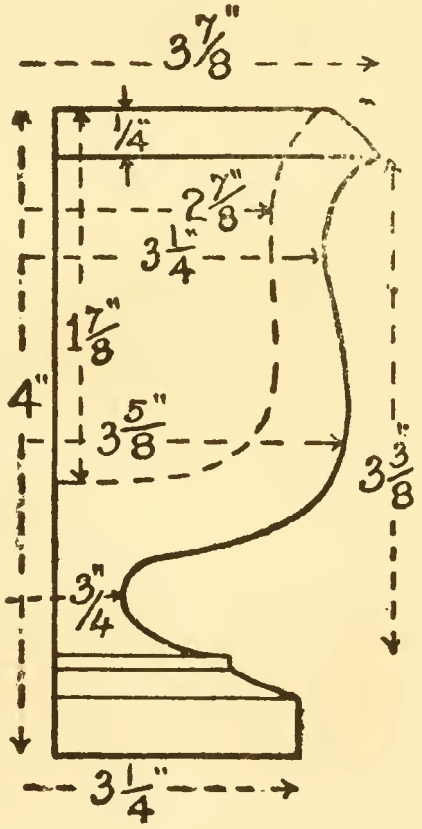


FIG. 111.—TURNED VASE WITH SKETCH SHOWING DIMENSIONS.



The wood is first turned in the form of a cylinder, by mounting it between the live centre and the dead centre

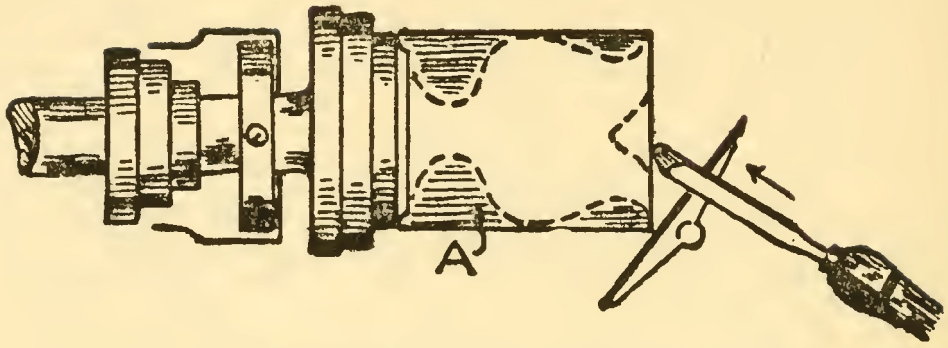


FIG. 112.—HOLLOWING A VASE. SHOWING INCLINATION OF TOOL REST TO LATHE BED.

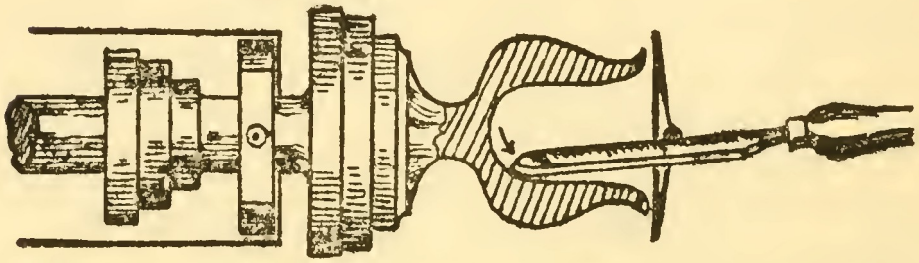


FIG. 112A.—HOLLOWING A VASE, SECOND OPERATION.

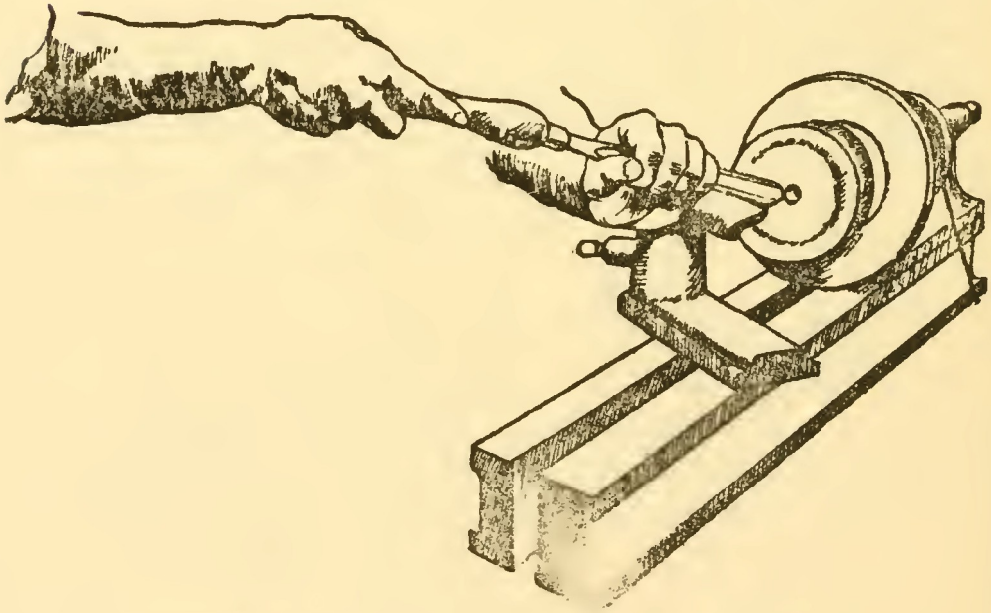


FIG. 113.—SHOWING POSITION OF TOOL (HELD SLIGHTLY DOWNWARDS) WHEN HOLLOWING.

of the lathe, after which it may be mounted on the face plate or large chuck similar to Fig. 100 or Fig. 101, *c*. The work will appear as a cylinder mounted on the face plate (A, Fig. 112.) The writer, speaking generally, prefers to hollow his work before turning up the outside of the vase, but no hard and fast rule can be given.

A hole, about 1¼ ins., is first bored in the centre of the vase, so as to remove that portion of the wood around the axis. Fix the tool rest so that its inclination is about 45 degrees to the lathe bed (Fig. 112), and hold the gouge so that the work has a tendency to force the

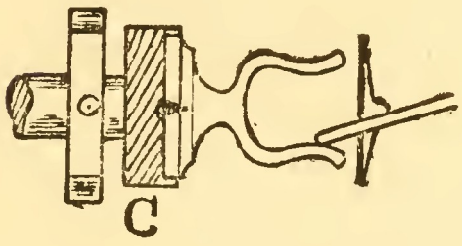


FIG. 114.—POSITION OF TOOL AT LATER STAGES OF THE WORK.

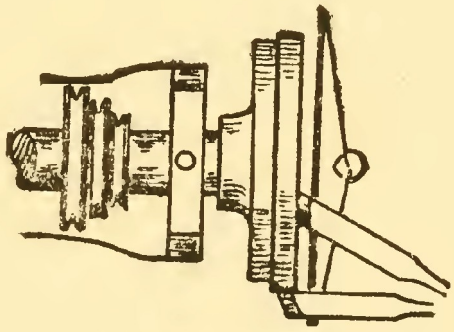


FIG. 115.—SHOWING METHOD OF TURNING DISCS, ETC.

tool towards the operator. Figs. 112, 112A and 113 show the positions of the tool. When the work has been roughed out to a depth of about 1½ ins. it will be found that the leverage is too great to obtain successful results by this method, and that the rest and tool will have to be used as at Fig. 114. The interior of the vase may be finished by using the scraping tool (Fig. 30.) The exterior of the vase may now be carefully turned up, and the whole of the work finished by using two grades of glass-paper.

Turning Discs.—Fig. 115 is a plan showing the manner in which discs, such as bread platters, etc., may be

turned on the face and trimmed down at the edge. Other examples of face plate work which may be suggested to the amateur are the top ring of a palm stand having a moulded edge, and sunk pie top crust table tops or shelves.

Frequently we find that the amateur has not obtained a gap bed lathe as illustrated at Fig. 116, and it is therefore necessary when he desires to turn work of a large diameter, such as 18-in. or 20-in. circular table tops, he

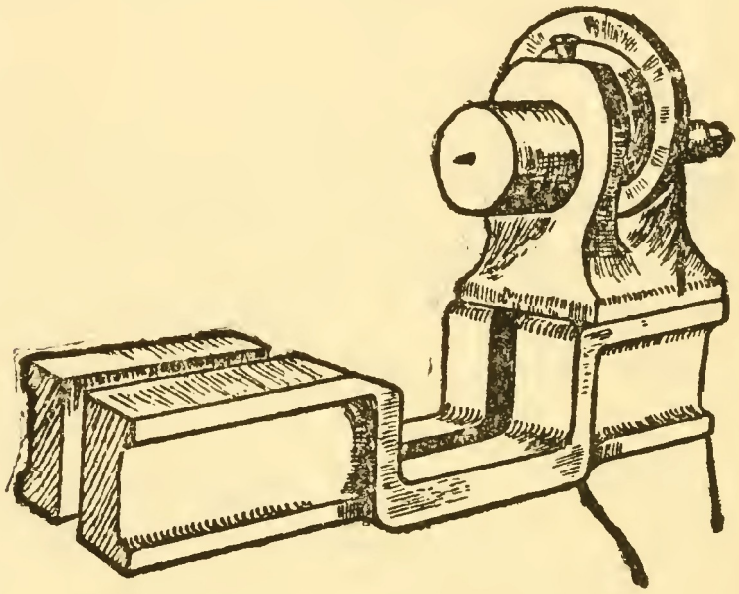


FIG. 116.—GAP BED LATHE.

is at a loss to know how to manipulate his work. The writer on many occasions has turned up 20-in. table tops by fixing the work to the face plate, and reversing his headstock so that the work overhangs the end of the lathe as shown at Fig. 117. Although not possessed of the portable tool rest shown in this illustration he manages perfectly well with a temporary home-made contrivance on which he has made arrangements to mount his existing tee rest. Another method of turning large work, such as legs of a large diameter, is to pack up the head and tail stock of the lathe with a piece of

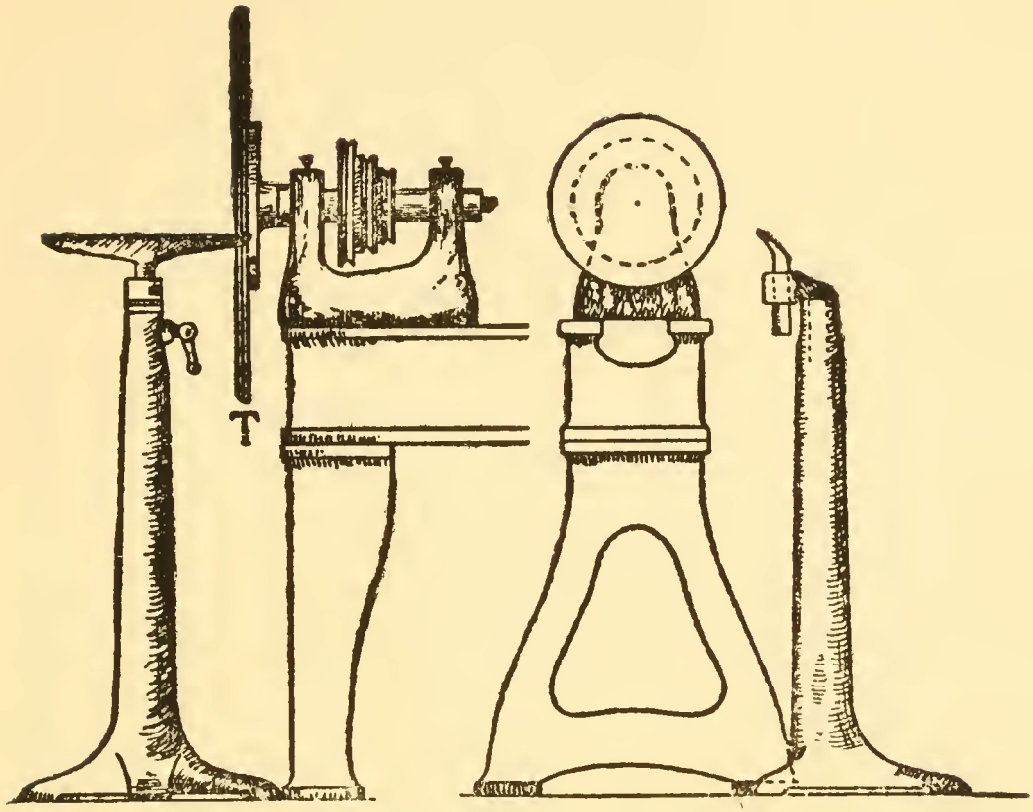


FIG. 117.—LATHE WITH HEADSTOCK REVERSED, SIDE VIEW; ALSO END VIEW, SHOWING THE REST.

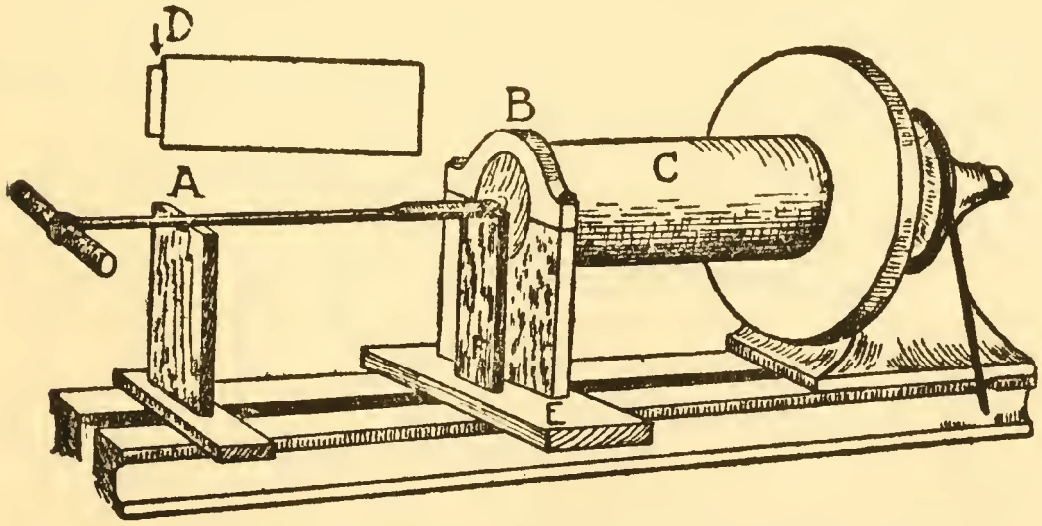


FIG. 118.—DEEP BORING A ROLLER WITH SPOON AUGER.

3-in. timber and lengthen the driving belt as indicated by Fig. 119.

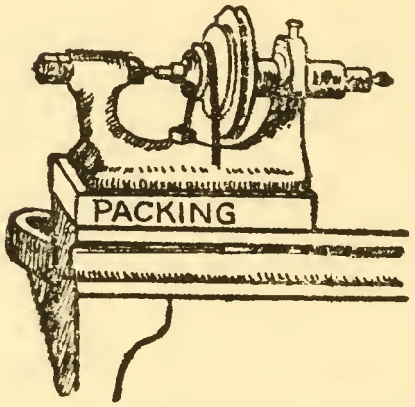


FIG. 119.—" PACKING " A HEADSTOCK.

Temporary Supporting Collars are generally home-made affairs, and constructed as from time to time may be required. They are used to hold up work at the

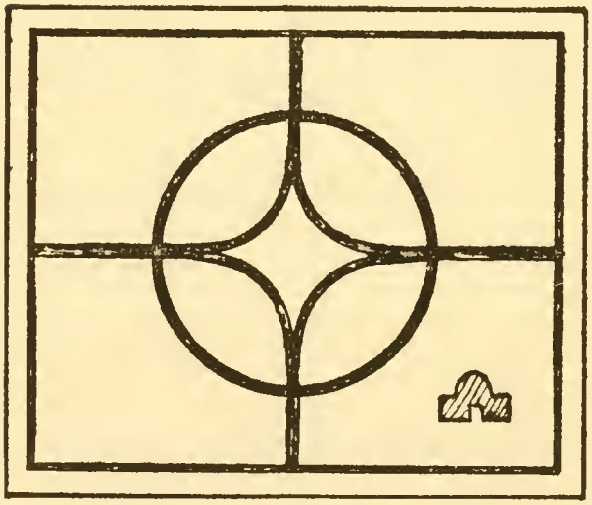


FIG. 120.—HOW TO TURN ASTRAGAL BEADING FOR BOOKCASE DOORS.

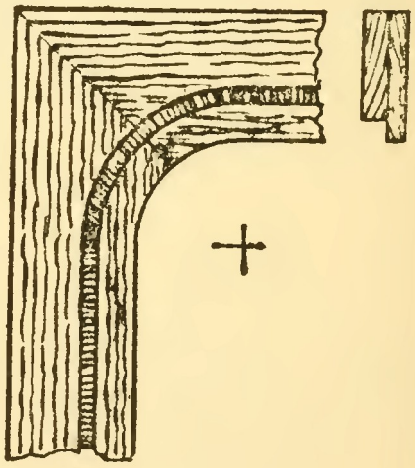


FIG. 121.—TURNING QUARTER CIRCLES FOR DOOR FRAMES.

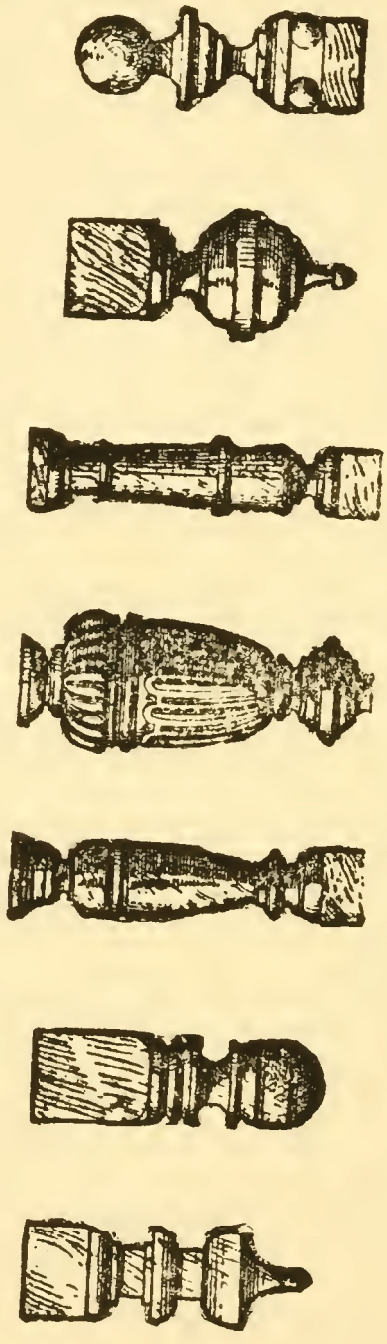
opposite end to the headstock. Fig. 118 is an illustration of the method of boring a dividing roller as used in a cotton mill. The roller is first roughed down between the ordinary centres, and a small shoulder (D) is turned

on it so as to fit the supporting collar. The roller is now mounted on the face plate (or a self-centreing jaw chuck may be used) and the opposite end is lubricated with tallow and runs in the collar (B). The work is revolved in the lathe, and, by the aid of a long spoon-nosed auger bit, a central hole may be bored down the entire length of the roller; after which the work is mounted on its steel spindle and the outside is turned up to the desired pattern. A and F in Fig. 118 are the supports of the auger; whilst B is the collar portion to support the work. In the example given the support and the collar portion are both tenoned and screwed into a base board which is common to both. E is the base-board.

The object of illustrating this example is to give the idea of manipulating work such as rollers, fishing rods, etc., when it is desired to bore the work whilst still in the lathe, and it will no doubt open up possibilities of other classes of work to the novice.

Turning Moulds for Barred Doors.—Good work can also be obtained from a judicious use of the face plate in such cases as that shown at Fig. 120. A tracery or barred door consisting of circles (and parts of circles) is shown, and the astragal or bead moulding may be turned up on the face plate.

Fig. 121 is another instance where lathe work may be utilised for inlaying quarter circle corners, the ring of satinwood being turned up to the required width and afterwards sawn into four pieces. Cabinet door frames, having quarter circle bolection mouldings, may be turned up in a similar manner.



EXAMPLES OF MISCELLANEOUS TUDOR TURNINGS.

TURNING A BALL

THE following method is one of the best for the turning up wooden balls where great accuracy is desired, and work may be guaranteed to within 1-64th of an inch if care be taken during the turning process. The balls are first roughly turned, so as to leave a plug or stub at one end (Fig. 122). The plug portion (P) is then tightly driven into the hollow portion of the mandril spindle, as at Fig. 123, and the ball is turned up without the use of the tailstock

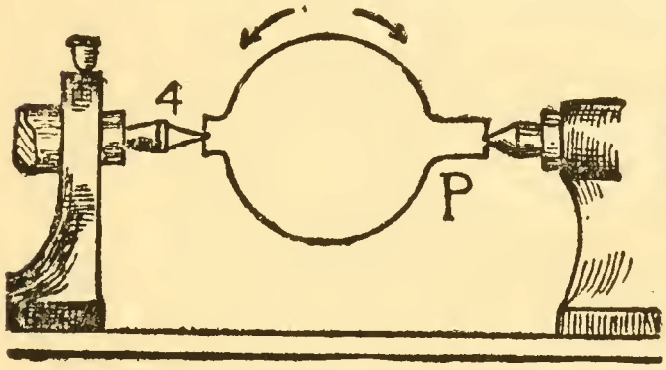


FIG. 122.—FIRST OPERATION IN TURNING A BALL.

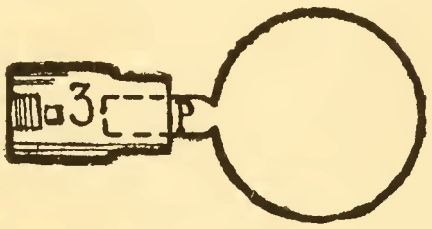


FIG. 123.—PLUG DRIVEN INTO MANDRIL SPINDLE.

as shown at Fig. 124. This view shows the approximate result obtained by the average worker; and it would be quite correct enough for balls such as are used in the fair ground for cocoanut or Aunt-Sally shies.

A Limit Gauge is now made out of a suitable piece of metal, this being somewhat similar in shape to Fig. 132. A ball tool is next made as at Fig. 128, the cutting end of the tool (A) being ground exactly to the radius of the finished ball. A cup chuck is now turned up out of a piece of box or beech wood, similar to the form shown at Fig. 129. A cup chuck of this type can be used for turning balls of varying sizes from $1\frac{1}{4}$ ins. up to $3\frac{1}{2}$ ins. in

diameter, and an advantage it possesses is that it is to a certain degree self-centreing.

A Nose Piece is next made out of boxwood, and a sketch of this is shown at Fig. 127, reverse and obverse ; it fits snugly yet loosely over the tail centre, as at Fig. 126. Grease the inside of the nose piece so that it can revolve freely upon the tailstock (C) with the ball. No other tools or appliances will be needed save those usually found around the wood turner's lathe, with the exception of a H H grade lead pencil.

It is advisable to first rough out the balls as near as possible to the correct diameter, paying less attention to the end portions, except to note that they are large enough to finish to the required diameter. If possible, finish a strip around the middle of the ball as wide as the end of the cup chuck, *e*, Fig. 126.

The Ball Tool Cutter, Fig. 128, is made wide enough to cut a bearing for the cup chuck. For instance, if the width across the cup chuck is 1 in., the width of the ball tool should be about 1 in. ; it will then only be necessary to push the cutter against the ball when it is yet on the end of its plug as at Fig. 124, *d*. After this bearing, or path, for the cup chuck has been made, hold the point of the lead pencil against the ball whilst the lathe spindle is revolving, and a mark will be produced as at Fig. *d*, 124. This mark is the measure mark to which all future efforts in finishing the ball are to be directed. Next, turn away the plug piece and place the ball in the cup chuck as at Fig. 125, with the pencil line passing under the chuck so that the chuck bears entirely upon the strip of work which was finished by the concave ball tool, Fig. 128. When this can be done (and it is simply a matter of having a suitable cup chuck, or of reducing an old chuck to the correct size by turning it down) it simplifies the work and enables the operator to

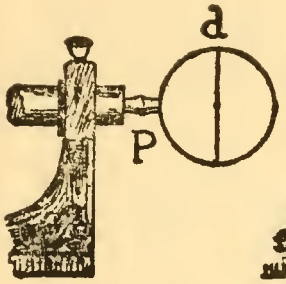


FIG. 124.—
BALL ROUGHLY
TURNED.

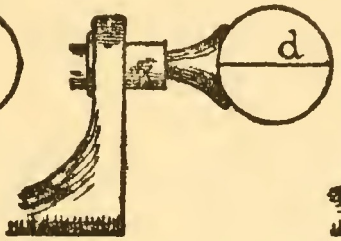


FIG. 125.—
SHOWING CUP
CHUCK.

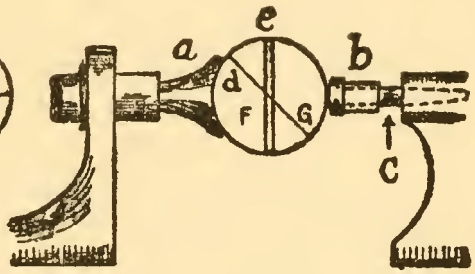


FIG. 126.—
SHOWING BALL BETWEEN
CUP CHUCK AND NOSE PIECE.

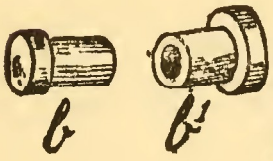


FIG. 127.—
NOSE PIECE.

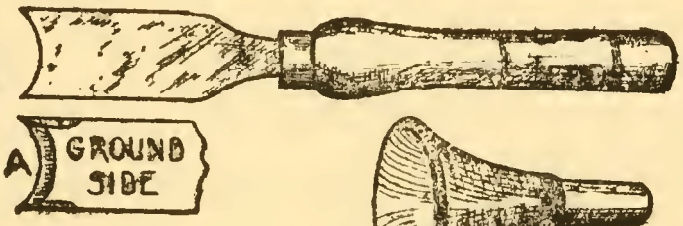


FIG. 128.—
BALL TOOL.

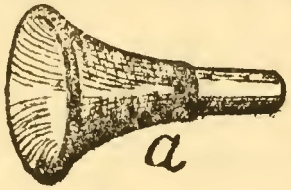


FIG. 129.—
CUP CHUCK.

FIG. 130.—
FINISHED BALL.

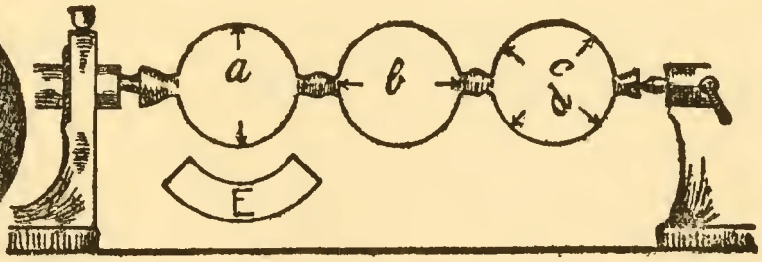


FIG. 131.—ROUGHING DOWN TO MAKE
THREE WOODEN BALLS.

finish the ball with but one or possibly two settings in the cup chuck.

The ball is now self-centred between the cup chuck (*a*) and the revolving nose piece (*b*), Fig. 126.

Finishing the Ball.—The ball is then ready for the finishing process, and with a gouge and the callipers at hand cut the shallow path *e*, Fig. 126, until the callipers indicate the required diameter. Once the channel *e* has been made, again put on the pencil mark, and use the ball tool shown at Fig. 128. This will finish a new belt or path around the ball, which is wide enough to engage with the cup chuck.

The mark *d*, Fig. 124, was made while the blank was chucked on its plug ; and it will be noted that when the ball has been sized down at *e* it had previously been sized at *d*, and the mark *d* and the channel *e* just touch each other. If the ball be worked with the tool, Fig. 128, this will have to be applied very carefully, the lathe being stopped occasionally if necessary to see the line *d*, Fig. 126, along the entire length cut by the tool, which perhaps will be from F to G.

If the work be done by the chisel or the gouge, it must be done in the same manner, viz., cut down just to the line *d*, not a bit further, or the ball will be spoiled. Thus having once callipered the ball at *d* (or, more properly, at *e*) and made a finished bearing place for the cup chuck, no further callipering will be necessary. The line *d* (or the one made at *e*) is what the geometrical expert would call a " great circle," and no matter at which angle that circle be turned, if we work the material down from all sides exactly to that line, we will have a perfect ball remaining inside the circle in question.

It appears as though there would be danger of getting the ball chucked out of the centre one way or the other, and then there would be a possibility of cutting too deeply at the points half way between the segments of

circle *d*. There can, however, be no possibility of thus damaging the ball, owing to the fact that, no matter how much the ball may be chucked, the portion of the line *d* on the high side of the ball will be reached by the tool before material can be cut away down to the finish line or any other portion.

The only possible exception to this is when a hole is deliberately dug into the ball at, say, G, Fig. 126, thus cutting a small circle which does not pass through any portion of the great circle *d* or *e*. This would, however, be avoided by using the callipers until the great circle has been established, then turning the blank in the chuck until a portion of the great circle is underneath the chuck which rests upon a finished surface. The pencil mark is a sure guide which may be relied on implicitly by the turner, without the least fear of cutting too deeply. Of course, there is a danger that he will cut below the pencil mark at any given point, and this can only be guarded against by closely watching the mark in question.

Testing the Accuracy of a ball may be done as follows :—Take a piece of thin sheet brass about 15

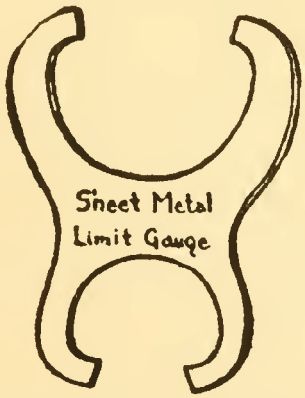


FIG. 132.—DOUBLE-ENDED LIMIT GAUGE.

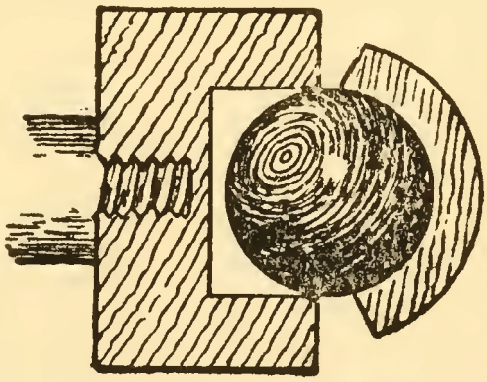


FIG. 133.—SECTION OF HOME-MADE CHUCK.

gauge, and bore a circular hole through this material to the desired diameter of the ball. The ball is tested by passing it through this hole several times in various

positions. Billiard balls, and similar articles, may be tested in a similar manner.

Turning Common Balls.—For turning up a wooden ball of the common type where great accuracy is not required, the following is a good method : Rough down a cylindrical piece large enough to make three balls as at Fig. 131. Use the callipers to test the balls first at *a*, then at *b*, then at *c*, and lastly at *d*. This will give an approximate ball near enough for ordinary purposes. Some workers prefer to use a small template of $\frac{1}{8}$-in. wood

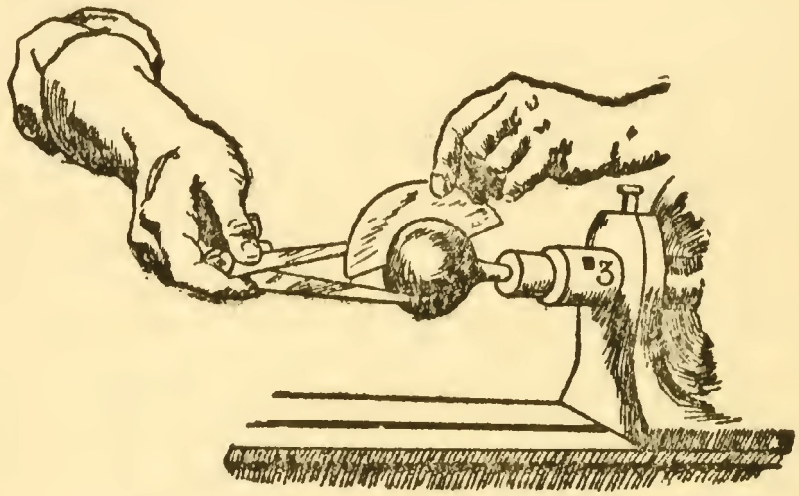


FIG. 134.—TESTING WITH CALLIPERS AND TEMPLATE.

as at E, Fig. 131. The inside edge of the template is made to the desired radius and rubbed with black lead, so that when the ball is tested with the template the high portions touch it and automatically become marked with lead. This testing is carried on from time to time, and the protruding portions of the ball removed.

Other workers prefer to start the work as at Figs. 122 and 123 ; after which they place the ball in a home-made chuck, a section of which is given at Fig. 133. The ball is taken out and re-chucked from time to time and tested with the template as shown. A sketch is given at Fig. 134 showing the combined use of the callipers and template before cutting the ball off its plug.

TURNING WOODEN RINGS, SQUARE TURNING, ETC.

WOODEN rings for palm stands, cornice poles, etc., are required from time to time for existing work, and some difficulty may be experienced in obtaining or matching this class of turning. The ability to turn such rings will enable one to be made to any size or pattern in any kind of wood.

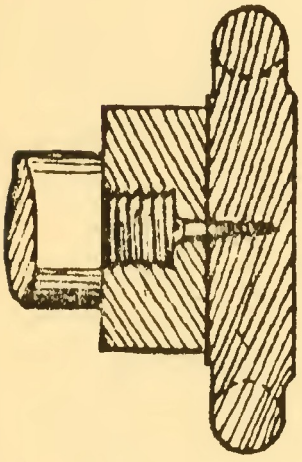


FIG. 135.

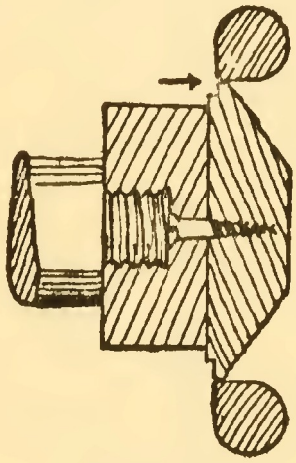


FIG. 136.

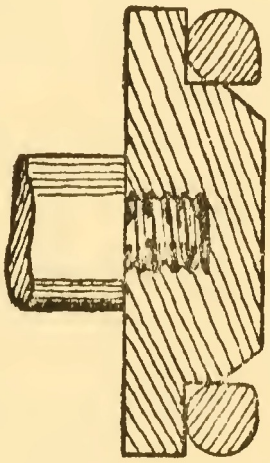


FIG. 137.

SHOWING METHOD OF TURNING CORNICE POLE AND OTHER WOOD RINGS UPON A SCREW CHUCK. FIG. 137 INDICATES THE USE OF A SADDLE.

Cornice Pole Rings are best turned upon a screw chuck, and it is advisable to start the work by using a disc of wood a trifle thicker than the finished ring is required to be made. First turn the outside of the rim to the desired section, and at the same time turn down the disc to the required thickness as at Fig. 135. The disc is now turned on the front, thus forming one side of the ring, and cutting the disc to within one-sixteenth of an inch, or thereabouts, as indicated at Fig. 136.

The partly formed ring is cut off the disc by taking a cut from the back of the work as suggested by the arrow at Fig. 136.

Use of Saddle.—The ring has now to be finished at that portion which was the back. To do this make a temporary wooden block or saddle to hold the work; the shape of the saddle with the ring mounted on it is shown at Fig. 137. The ring fits tightly on to this

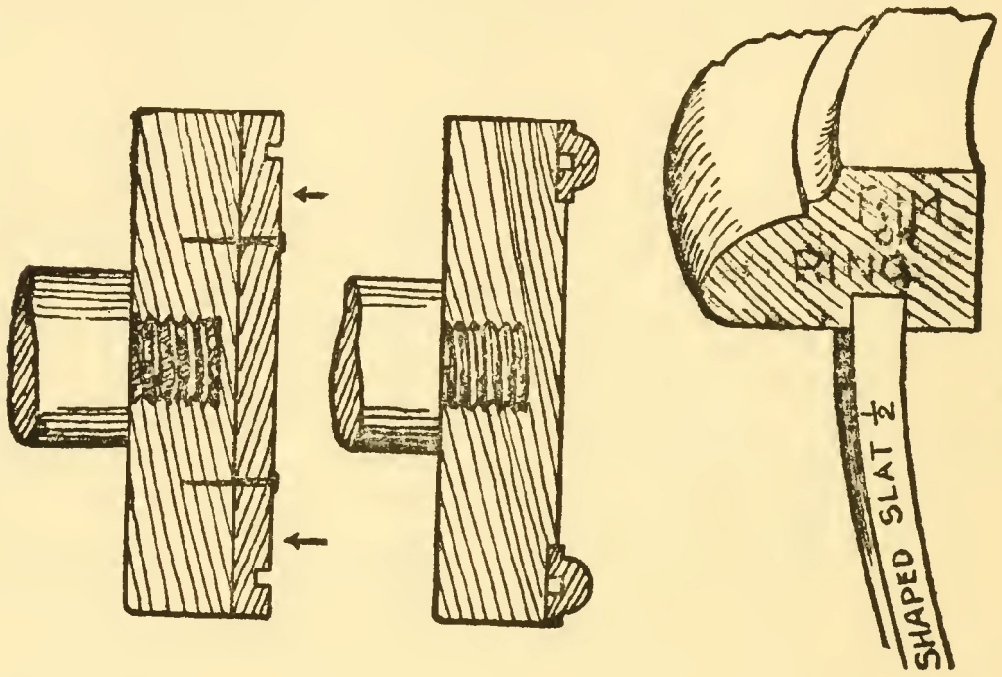


FIG. 138. FIG. 139. FIG. 140.

METHODS OF TURNING WOODEN RINGS OR RIMS.

block (or saddle as it is called) and the friction will be sufficient to hold it in position whilst the turning is completed. The half circle wooden handles for box or heater irons as used in nearly every household are made by turning rings and then cutting them in half. By similar methods of working and by a judicious use of saddles many articles may be turned on the lathe, which at first sight appear to the inexperienced worker to be almost impossible of manipulation.

At Fig. 138 is shown a grooved circular astragal moulding, such as is used when building up a barred or tracery door as shown at Fig. 120. Segments may be cut from this turned ring so that they will intersect with the straight portions of the moulds which form the tracery door; and, by using portions of turned rings instead of hand-made free curves, the cost of production is considerably lessened. A piece of suitably straight grained wood may be secured to the wood face plate, by the central screw, as at Fig. 135, or it may be held on the face plate by using nails or screws as at Fig. 138. The circle is turned to the required diameter, after which the groove is turned into it as shown at Fig. 138. The central portion of the block is then turned away, as shown by the arrow mark, and the worker is left with a ring of the required width and thickness and having the necessary groove in it.

The wood face plate is now turned down to provide a seating for the ring; the ring is placed on this seating and held there by friction whilst the work is turned up to the required shape as shown at Fig. 139. The top rim or ring for palm stands, Fig. 140, and a hundred and one articles of a similar nature may be turned up by adaptations of the methods shown above.

Square Turning.—Square turnings are made on a somewhat costly machine which consists of a sliding metal table actuated by a screw feed. The blocks of wood are fixed on to the table, one behind the other, and securely clamped down. The table top with its load of twelve to twenty legs, according to size, is then passed under a set of revolving cutters which give the required pattern on one face of the leg. The legs are loosened, and given a quarter turn so as to bring a new face of the work in contact with the cutters; this is repeated four times in all to complete the work.

In the modern machines the work is fed under the

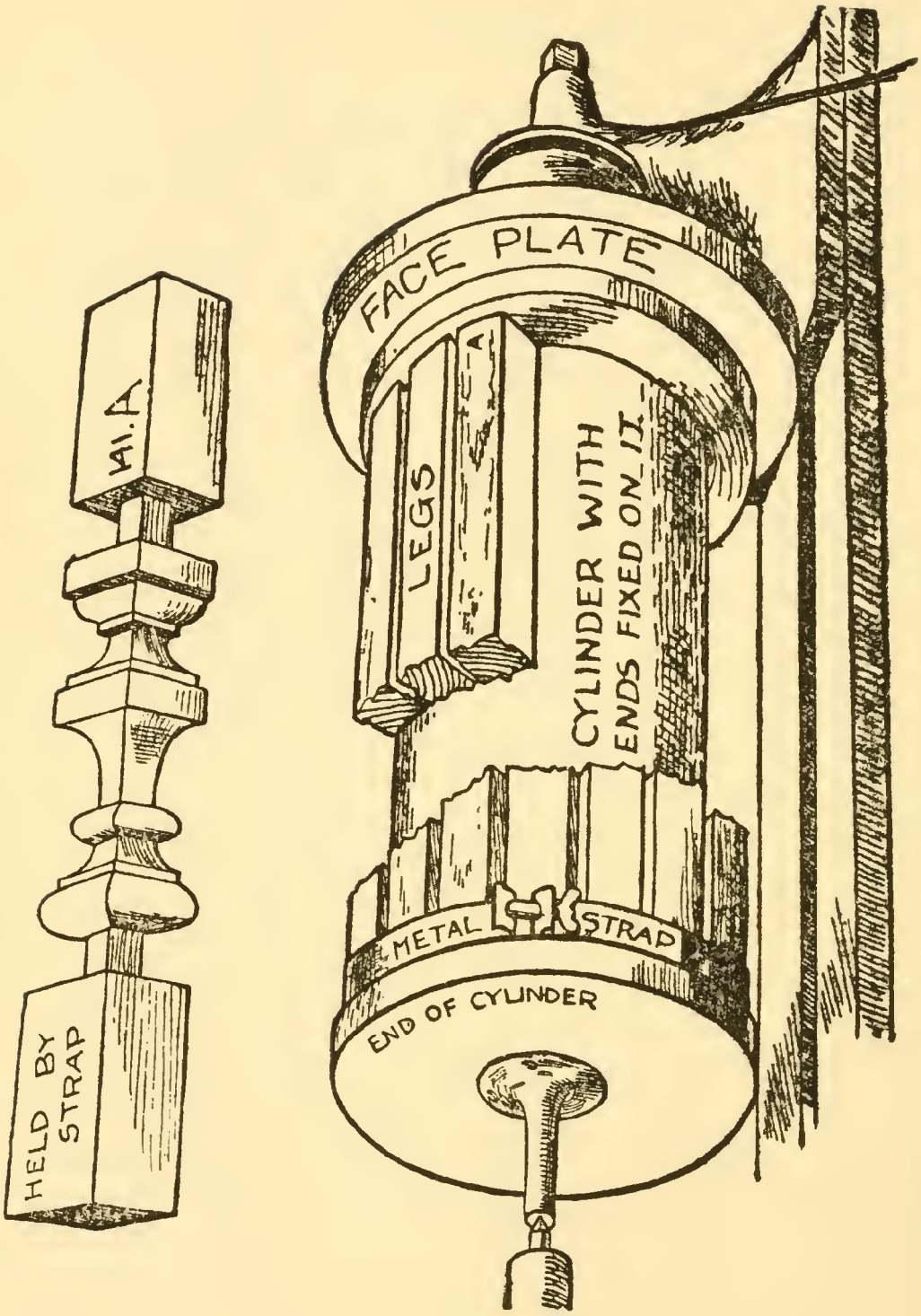


FIG. 141.—SHOWING THE OLD METHOD OF QUASI-SQUARE TURNING (OR "THERMING") BY MEANS OF A BUILT-UP CYLINDER. THE SKETCH ABOVE (141A) SHOWS A FINISHED EXAMPLE OF SQUARE TURNING.

cutters, *with the cut,* instead of *against the cut,* as is the case with a planing machine. This does away with temporary packing to prevent the last edge which is being cut, from crumbling, or showing a faulty edge.

Quasi-Square Turning was in great favour long before the introduction of wood working machinery,

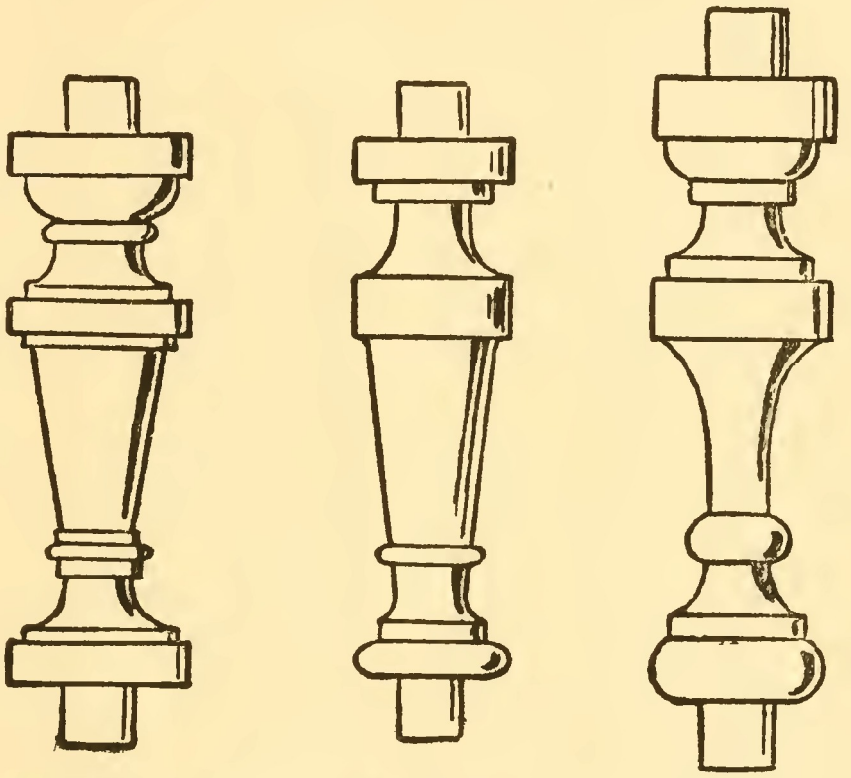


FIG. 142. FIG. 143. FIG. 144.

EXAMPLES OF SQUARE TURNING PATTERNS.

and a short paragraph showing how the old craftsmen tackled this problem will be interesting to those who wish to try their hand at this class of work. A built-up barrel or cylinder similar to that shown in Fig 141 was made and turned up between the lathe centres. The centre of the barrel has an iron rod running through it, and it is on this rod or axle that the centres of the lathe engage. The blocks of wood are planed up true and square and cut off to exactly fit in the cylinder as shown.

The cylinder is filled full with the prepared blocks, and these are held in position by steel straps which have bolts and wing nuts attached to them so as to pull up tightly in exactly the same manner as a chair maker's cramp. The old workers used a leather strap, or in many cases simply nailed each block down on to the cylinder. A strap is fixed at each end of the cylinder so as to hold the work tightly down and this accounts for

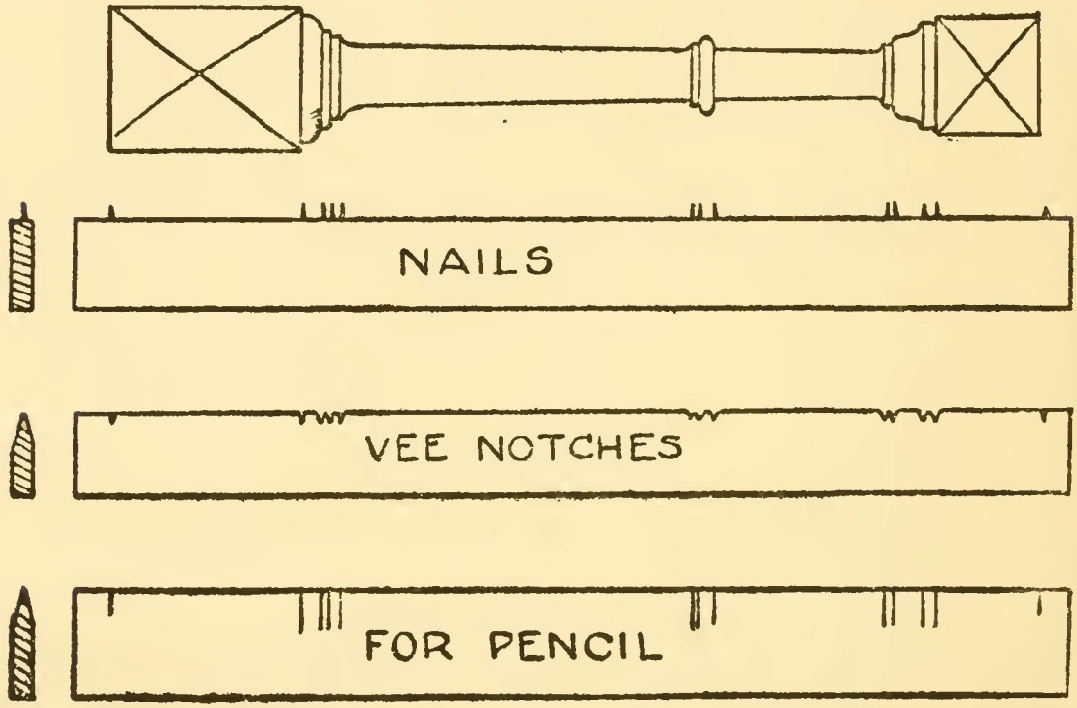


FIG. 145.—SETTING-OUT LATHS FOR REPETITION WORK.

the square portion, A, at each end of the turning, which cannot be used.

The work when mounted so as to fill the cylinder, is revolved between the lathe centres in the usual manner, and the work is turned up by the aid of the gouge and chisel to the desired pattern. The straps are now taken off and each leg or spindle is given a quarter turn on the cylinder so as to bring a new face of the work in contact with the tools. The straps are replaced and tightened up; the work is revolved, and a second face is thus

turned up to coincide with the one already worked. The operation is repeated four times; that is, of course, until all the faces of the work have been turned.

Difficulties will be experienced when turning the last face of the work, as the remaining edge will have a tendency to chip or crumble owing to there not being sufficient wood to resist the pressure of the turning tools. There is no royal road to success with regard to this last edge, and there is no way of overcoming the difficulty, except the old-fashioned method of making shaped packing pieces to fit and fill the interstices. Owing to the cost and trouble in turning this class of work on the lathe it is not in general use, although when neatly executed with details of good proportion it is exceedingly effective.

This turning was called by the old craftsmen "Therming," and, of course, the larger the diameter of the cylinder on which the work was done the more effective was the so-called square turning.

Three good examples of square turned spindles are given at Figs. 142, 143, 144. The members are choice and in good proportion.

Setting-Out Laths are used by wood turners whose several spindles or other turned pieces have to be repeated, such as turning a quantity of chair legs or balusters to a given pattern. For common work it is usual to take a piece of wood about $\frac{1}{4}$ in. thick and drive into the edge of this lathe a number of small wire nails or panel pins, the pins being filed up to a point. This lath is used to mark out the work to its extreme length, and it also marks out the distances between each member of the turning.

The rough wood is turned up cylindrically and the setting-out lath is held against it whilst the work is revolving. This causes the turning to be slightly scored or scratched by the protruding nail points; and thus

the work is set out lengthways to exactly the same size as the previous turning. Other workers prefer to dispense with the nails, and they draw with a pencil the required lines on their setting out lath. The lath is then held against the rough turning, and whilst it is slowly revolving the worker marks the turning with his

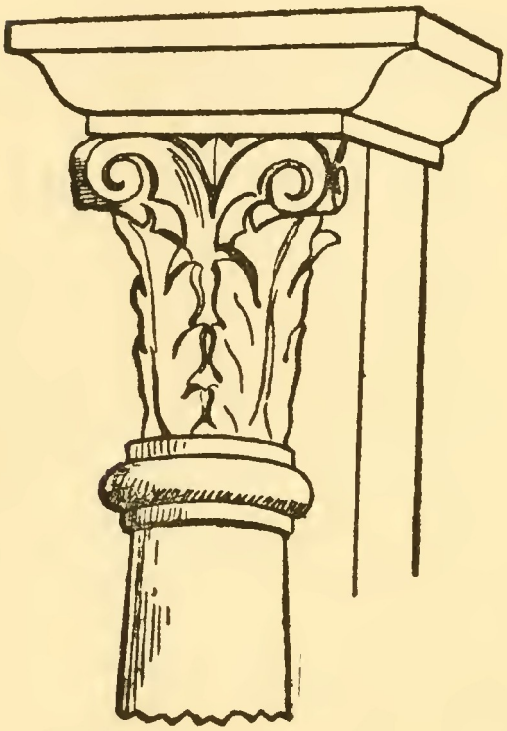


FIG. 146.
CARVED CAPITAL.

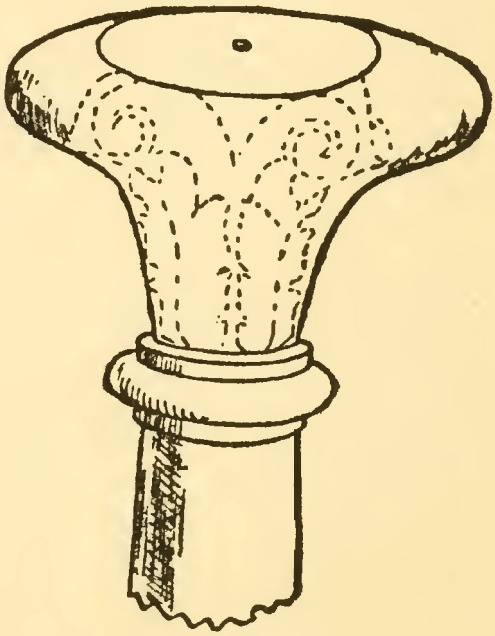


FIG. 147.
TURNING A CAPITAL PREPARATORY TO CARVING.

lead pencil exactly opposite his setting-out lath. Others, again, cut small notches into the edge of the setting-out lath, and hold the pencil point in each vee notch consecutively until the whole length of the turning is marked. All the above methods are good and the worker should use that which answers his own requirements the best. These laths apply to setting out the length only, as, of course, the diameters are callipered in the usual

way. Fig. 145 shows a turning pattern and the three types of setting-out laths.

Other types of setting-out or gauging laths are used to judge the correct shapes of long or deep curves. These templates, as they should correctly be described,

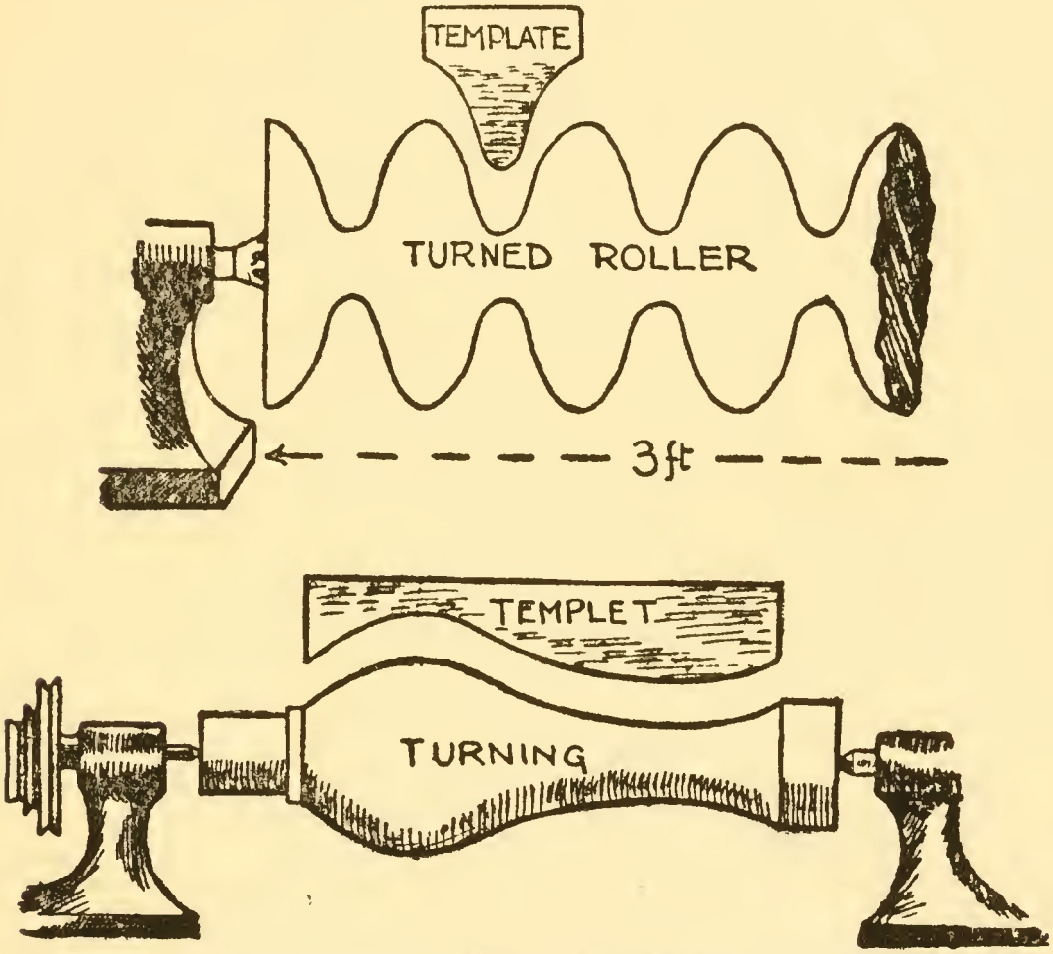


FIG. 148. SHOWING USE OF SHAPED TEMPLATES FOR SHAPED TURNINGS.

are made of thin wood such as three-ply or sawn veneer, and the application of them can be clearly shown in the two examples given at Figs. 148.

Turning for Capitals.—At Fig. 146 is shown a turned carved capital supporting a shelf or cornice moulding; much can be done by the wood turner so

as to ease the laborious work of the wood carver by turning the capital as indicated at Fig. 147. The greater circle which touches the highest points of the volute is turned, and this gives a guide to the carver when cutting out his work.

FINISHING TURNINGS

STAINING AND POLISHING

AFTER completion of the tool operations, the work is generally finished by using successive grades of glass-paper. The glass-papering is commenced by using fine 2 grade and finished by No. 1½. The glass-paper is generally folded and applied to the sketch as shown at Fig. 149. The glass-paper is moved longitudinally so as not to leave ridges on the work. In such cases, as where vee cuts and small fillets are to be operated upon, the glass-paper is folded so as to bring the sharp edge into contact with the internal portions of the turnings.

After the glass-papering is completed, it is usual to give a frictional polish to the work by using a handful of fine shavings which have been turned off the actual work (see Fig. 150). It is advisable to use turnings which have been turned off the work, thus ensuring the same hardness of wood ; as, if oak turnings were used to give a frictional polish to a soft wood like pine, the result would be a series of ridges and scratches on the surface of the work.

To Change the Colour of turned work, staining is resorted to ; and, if mahogany is being treated to match the cabinet work, it will be necessary to slightly weaken the stain before it is applied to the turnings. After staining, the work should be allowed sufficient time to dry thoroughly. It may then be again put in the lathe (provided the turning centres have not been cut off) and the raised grain carefully papered down with No. 1 or No. 1½ glass-paper. The stain may be applied to the work with a brush, as at Fig. 151, whilst slowly revolving the lathe.

After the stain has been papered down, the work

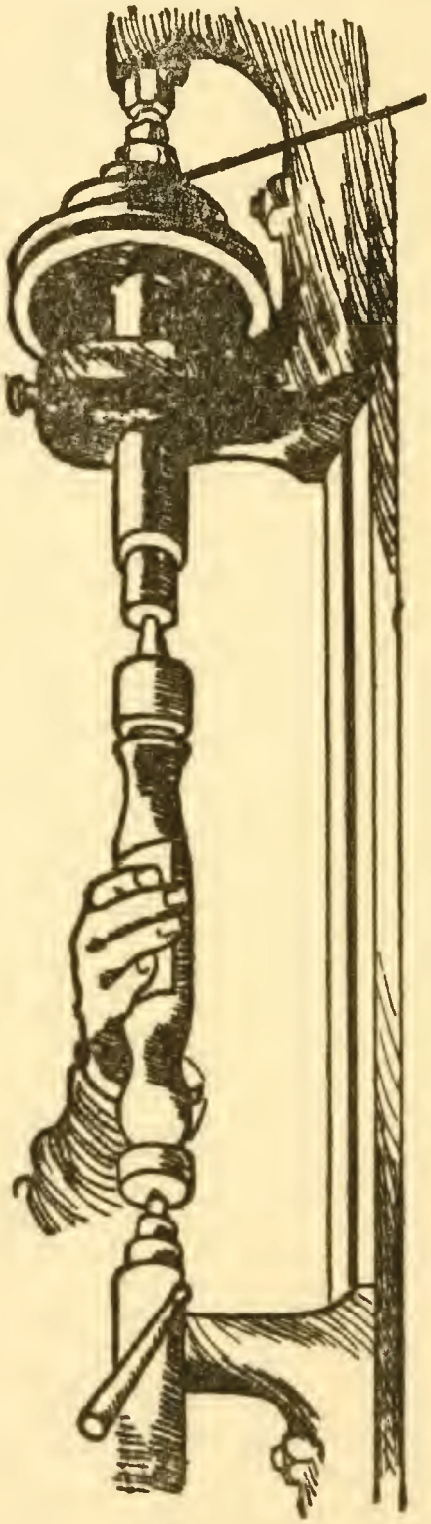


FIG. 149.—HOW TO GLASS-PAPER TURNINGS.

The glass-paper is moved longitudinally, so as not to leave ridges on the work.

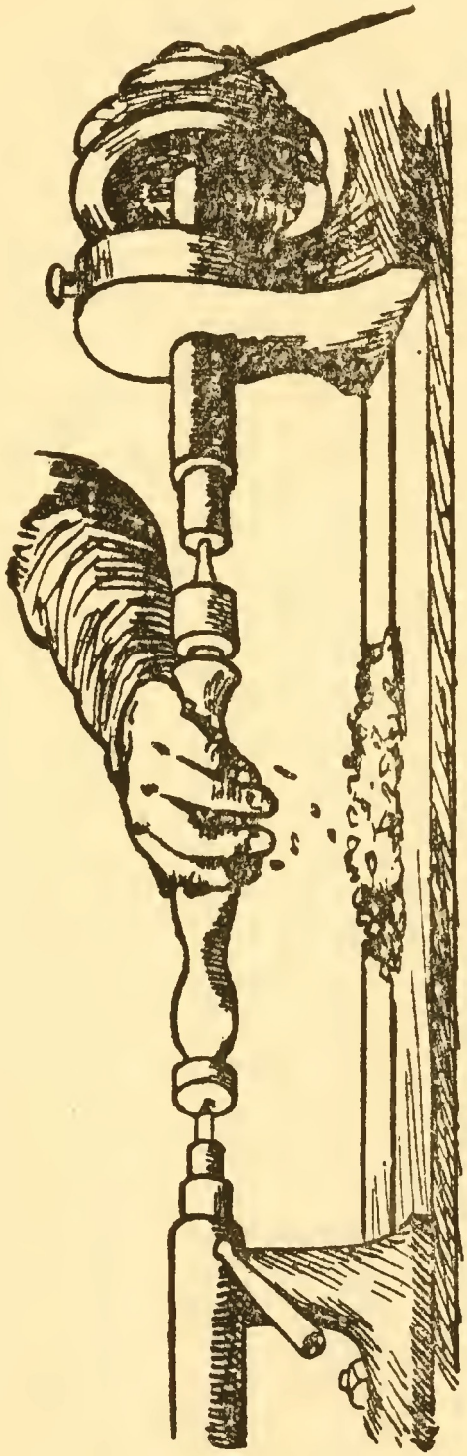


FIG. 150.—FRICTIONAL POLISHING WITH FINE TURNINGS.

This is done by holding a handful of fine shavings which have been taken off the actual work as shown.

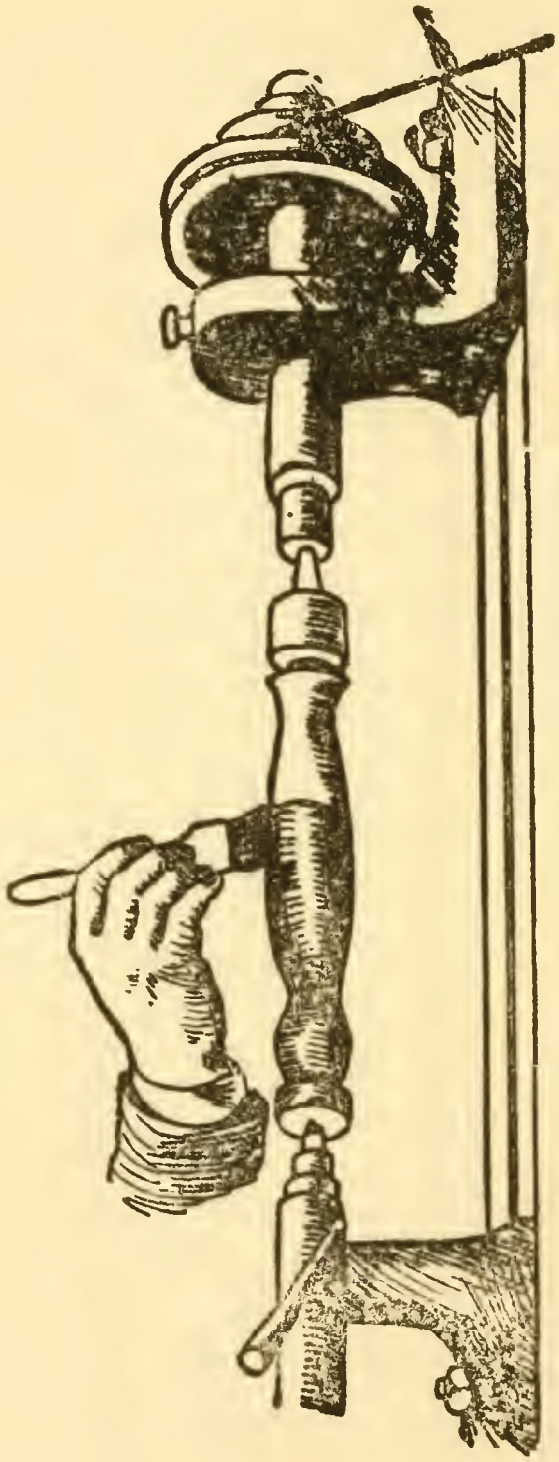


FIG. 151.—APPLYING STAIN WITH A BRUSH.

The brush is held as shown, whilst the lathe is slowly revolved.

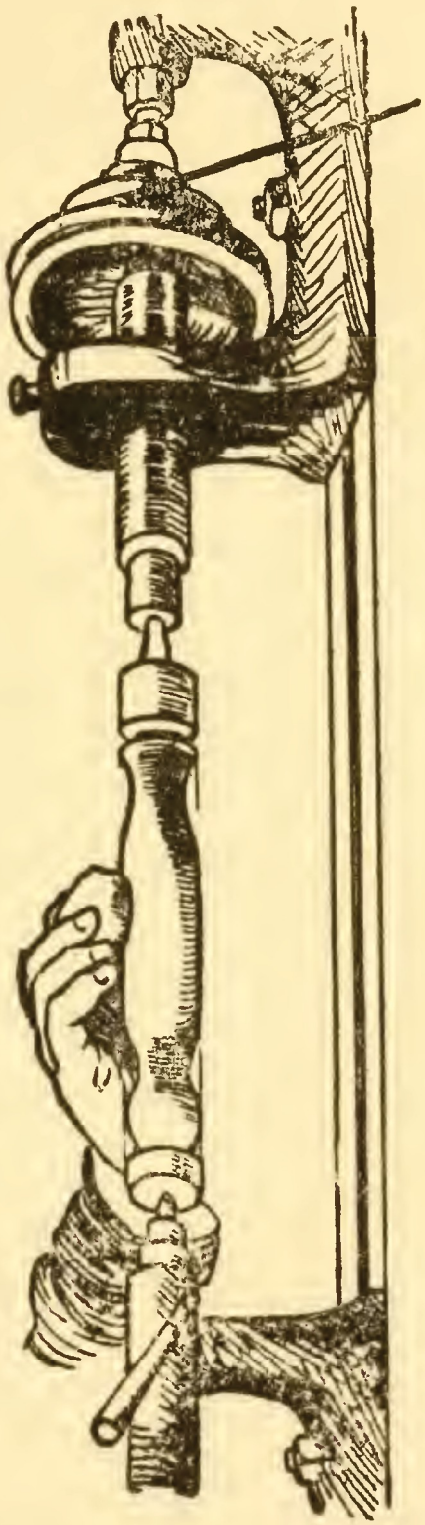


FIG. 152.—HOW TO HOLD THE POLISHING RUBBER.

At first the lathe is revolved slowly, the speed being increased as the work begins to shine after a fair body of polish has been applied.

should be examined, and if of a very wild or open grain, such as many species of African baywood or American oak, it may be advisable to fill in the work with a suitably coloured wood filler. The turning will in any case be wiped over with raw linseed oil, which may be applied with an oily rag whilst the work is slowly revolving.

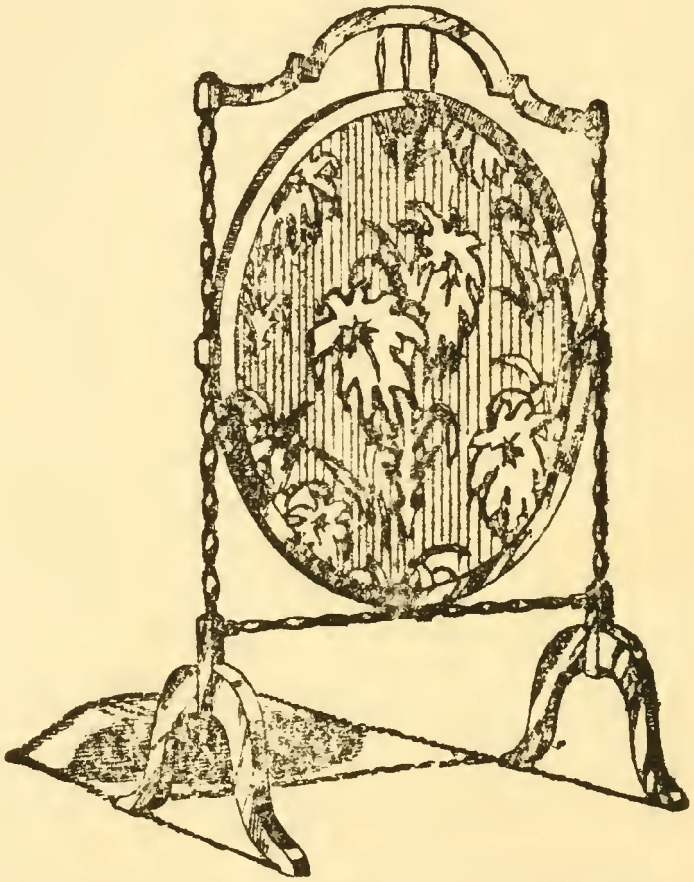
French Polish is suitable for applying to hardwoods such as walnut and close grained mahoganies, or such woods as satin walnut. After the work is oiled (and this should not be done too freely) the polish is used on a soft pad of cotton wadding covered with an open woven piece of rag, to which a spot of linseed oil is applied, so as to prevent it sticking to the work. Fig. 152 shows the method of holding the rubber. This rubber must be soft, fairly large, and charged with fairly thin polish. The work must be rotated slowly at first, until the polish begins to shine, and after a fair body of polish has been applied the speed may be slightly increased.

It is advisable to give the polish time to harden after a fairly good surface has been obtained; let it stand overnight if possible. Examine the work before bodying up the second time to see if any dust specks are present. If such are observed, carefully glass-paper the work with No. 0 grade, and proceed to again body up the work. To finish, give a light quick rub with a rubber charged with methylated spirit; this takes out all the oil and gives a clear and brilliant surface.

Many workers finish by using a pad made of nice soft rag, on which a little methylated spirit has been sprinkled; and this is probably the safest way for an amateur who has had little experience of this class of work.

Oak is generally polished dull by applying a solution of beeswax and turpentine. The wax compound is

well rubbed into the work, and as much friction as possible is applied with a linen or cotton rag—or, better still, a stiff brush, revolving the lathe first one way and then the other, and brushing the wax out of all the quirks and sunk fillets, etc. Much labour can be saved by bodying in all the turned work before framing the carcase portion of the work together, especially where a number of turned spindles, or chair or table legs have to be operated upon.



ORNAMENTAL FIRE SCREEN WITH TURNED PILLARS AND RAILS.

MISCELLANEOUS HINTS

TOBACCO PIPES—BUILDING SIDEBOARD AND OTHER PILLARS—ANIMALS FOR NOAH'S ARKS—GROUPING OF MEMBERS—TABLE OF SPEEDS—THE STORY OF THE LATHE.

THE turning of tobacco pipes is a very simple matter for those who have had some little experience on the lathe. A beech chuck is made and tapped at one end, so as to screw on to the mandril end (Fig 153), and the opposite end of the chuck is slotted so as to take the pipe blank (A). The

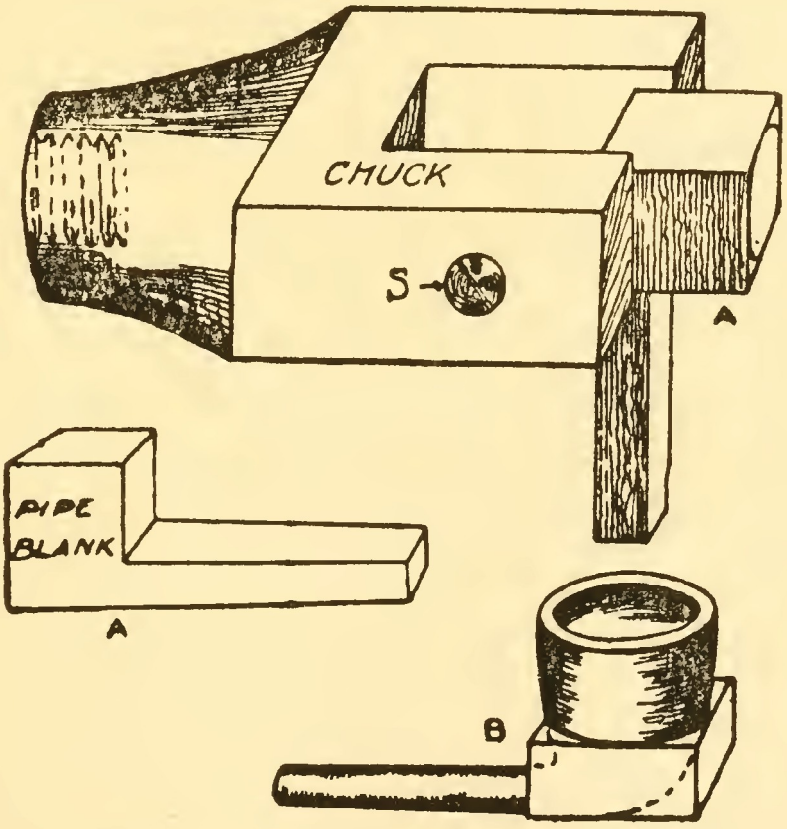


FIG. 153.—HOW TO TURN TOBACCO PIPES.

blank is gripped by compressing the jaws of the chuck by tightening up the screw S, the bowl of the pipes is bored

out with a spoon-nosed augur, and the outside of the bowl turned up.

The pipe is then released from the chuck and re-centred so as to allow of the turning up of the pipe stem. When the turning operations are completed the pipe will present the appearance shown at B, and is now ready for finishing by sawing away the superfluous wood and filing and glass-papering the lower part of the bowl to the necessary curvature.

Building Sideboard Pillars.—The majority of side-

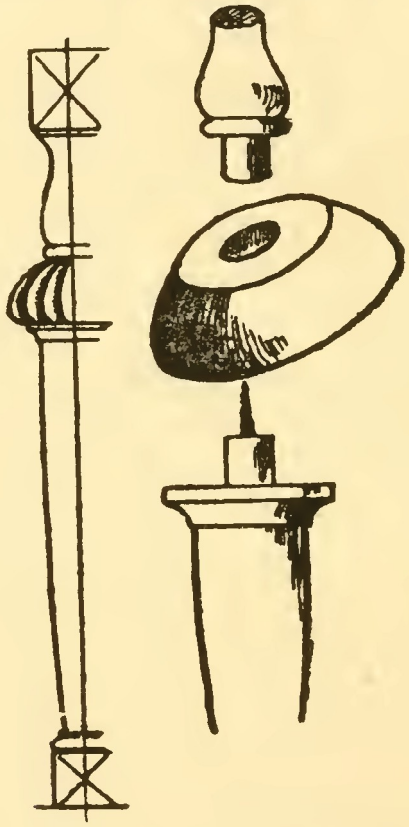


FIG. 154.—SIDEBOARD PILLARS.

board pillars used in present-day furniture have a large swell, and owing to economical conditions are frequently built up as illustrated at Fig. 154, that is, instead of wasting timber by reducing, the squares at the top and bottom of the turning, the swell, or bulb portion, is

inserted as shown. The upper and lower portions of the turning have pins formed upon them and a double pointed dowel screw is inserted as shown.

The bulbous portion is first bored so as to accommodate the turned pins, and it is then put on an arbor and turned up in the usual way. The parts of the pillar are then glued and screwed together, the swell concealing the joint. It is usual to carve up the bulb portion with reeds, as shown in the sketch.

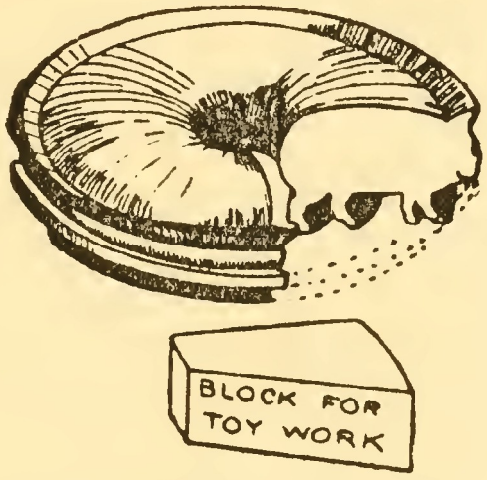


FIG. 155.—NOAH'S ARK ANIMALS.

Animals for Noah's Arks.—Many of the continental makers of toys, especially those engaged in the manufacture of Noah's arks and similar work, make good use of the lathe. An instance is given at Fig. 155 of the method of roughing out the formation of an animal on the face plate of the lathe. The blocks are cut to a suitable size and glued up so as to form a ring ; this is mounted on the lathe and turned up to the approximate contour of the animal desired. The timber is then taken off the face plate and again fixed so that the other side may be worked upon.

Sections are now cut radially, and in this manner the general contour of the animal is obtained. They are

afterwards brought up to a finish by hand labour. Many animals are thus obtained out of one ring of wood, and a close inspection will show that nearly all toy animals are narrower in width at the fore legs than at the hind-quarters.

Grouping of Members for Turning Patterns.—The Romans and Etruscans are often shown sitting or reclining on chairs or couches made of willow, viz., basket work, and a piece of sculpture in Treves Museum shows a soundly constructed wicker chair, the front legs of which are bound round with osiers.

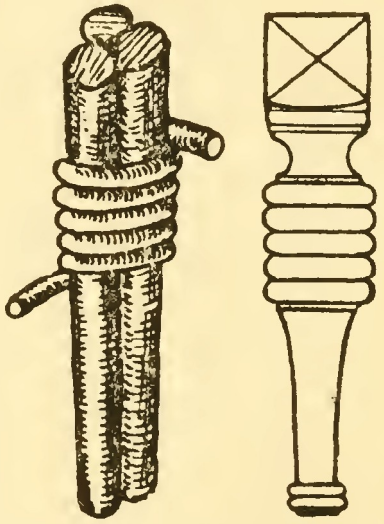


FIG. 156. FIG. 157.

EVOLUTION OF CHAIR TURNINGS.

It is probable that this binding of the legs, so as to strengthen them suggested the contour of the turned beads which are so familiar on chair legs, as at Figs. 156 and 157.

Turning patterns are made up of concave, convex, or serpentine lines, combined with fillets and vee cuts. These members are classified, and every wood turner should be familiar with their names. Fig. 158 illustrates

the members generally used by the turner. Take, for example, Fig. 159. Commence at the top and analyse it. First we have the square ; next the ogee, and the fillet : then we come to the serpentine swell and we find upon examination that even this shape is a combination of the

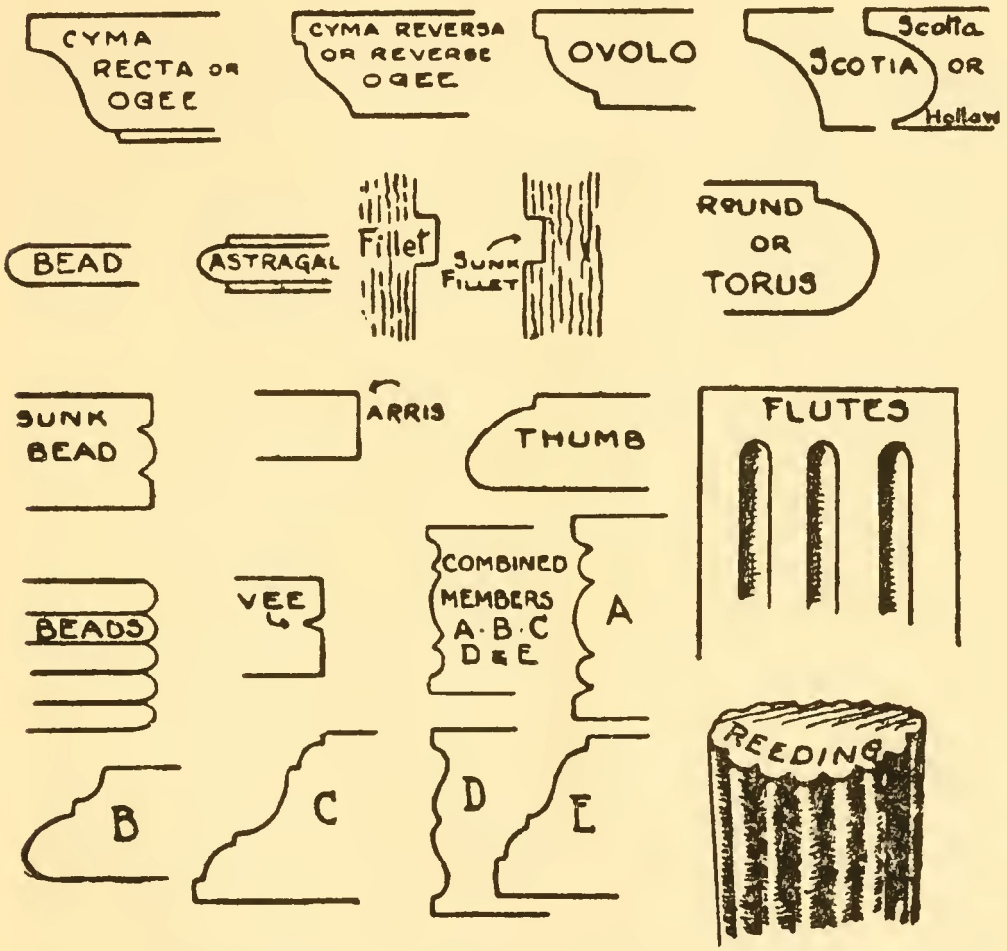


FIG. 158.—MEMBERS GENERALLY USED BY WOOD TURNERS.

hollow and round (or, to give them their correct names the scotia and bead). Small bead, fillet and scotia again follow ; after which we have a swell, which with its fillets might be classed as a large ovolo moulding. The ogee, fillet and major portion of the shaft follow on, and we arrive at the small astragal mould which breaks the upper and lower portion of the shaft. The shaft is

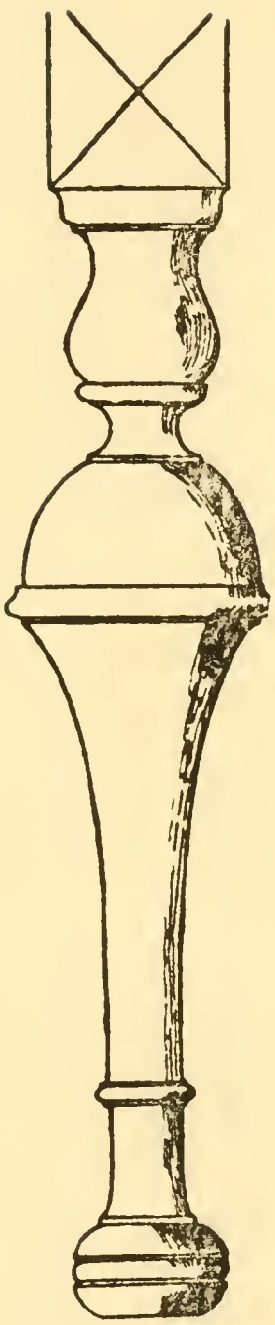


FIG. 159.—EXAMPLE OF TURNED SHAFT.

finished by a fillet and then we have the crushed ball form which is ornamented by a sunk bead. In turning patterns the general effect consists of a good grouping of the various members and a correct proportion of the lines which are used.

Table of Speeds for Power Lathes.—In all cases where power lathes are being installed for special purposes the following table of speeds should be consulted :—

DIAMETER OF WOOD TO BE TURNED.	REVOLUTIONS OF WORK PER MINUTE. Approximately
1 in. ..	.. 3,000
2 ins. ..	.. 2,500
3 ins. ..	.. 1,500
5 ins. ..	.. 1,000
8 ins. ..	.. 650
12 ins. ..	.. 570
18 ins. ..	.. 300
24 ins. ..	.. 250

After consulting the above table the advantage of driving lathes by variable speed motors is obvious.

The Story of the Lathe.—The lathe is probably one of the oldest types of woodworking machines, and there is little doubt that it was an adaptation of the potter's wheel. Theodor, of Samos, is mentioned by Pliny as the probable inventor (740 B.C.), and we read in Scripture that the ancient Hebrews were skilled in the use of the lathe. In India at the present day some of the

native workmen use a very primitive form of lathe as shown. It consists of two fixed centres, upon which the work revolves, and a cord running two or three times around the actual work, so as to obtain a backward and forward rotation. One workman uses the tools, whilst another actuates the cord similar to a jeweller's bow or fiddle drill. The operator brings his tool up to the work during the forward rotation and removes it during the backward rotation. The upright supports are generally driven to earth and the turner works in a sitting position.

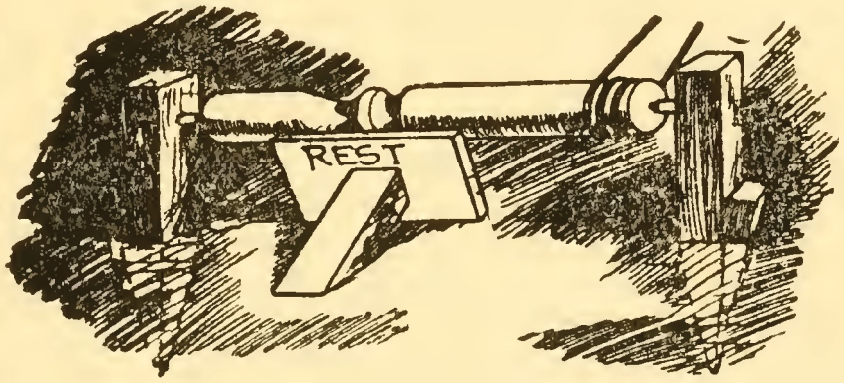


FIG. 160.—NATIVE INDIAN LATHE.

In this country the earliest form was undoubtedly the pole lathe, and as recently as the year 1910 pole lathes were occasionally to be seen in every-day use amongst the chair makers of Buckinghamshire. Rapid strides have been made in lathe production during the last fifty years, and we can now obtain automatic and semi-automatic lathes and back knife lathes, which will produce the same pattern of turned articles (clothes pegs, brush handles and chair legs) by the gross. Oval turning lathes for hammer shafts, bradawls, screw-drivers are in daily use throughout the country, and many forms of copying lathes are on sale which will turn golf stick heads, cricket bats, and even the legs for a rocking horse. Such

machines as these are necessarily costly, and are only used in wholesale factories. The amateur, however, can obtain an attachment to fix on the foot lathe for turning oval handles, etc., called an oval chuck. This was invented by William Murdock, who was an assistant of the celebrated engineer, James Watt.

PATTERNS FOR TURNINGS

DINING-TABLE LEGS—OTHER TABLE LEGS (SEVERAL WITH FULL-SIZED DETAILS) — COLUMNS — SPINDLES — CHAIR LEGS—NEWEL POSTS—HOUSEHOLD TURNERY —CHESSMEN

PATTERNS OF TABLE LEGS.

THE height of a standard dining-table from the floor to the top is 2 ft. 5 ins. This includes the castor and the lining-up moulding which is generally placed under the top to strengthen and clamp it. The wood turner generally prepares his legs about 2 ft. 4 ins. in height, so as to allow for squaring up the top of the leg. Where castors and castor rims are used the legs are turned to fit the rim, because different makers of castors and rims slightly vary their sizes. The turner should also prepare his work so as to leave sufficient material at the top of the turning to allow the cabinetmaker to mortise in his table framing. No hard-and-fast rule can be given for table framing. Some workers use a wide rail and cut or shape the centre portion away to allow clearance for the knees of a person when seated at the table. Other workers use a rail 4 ins. in width as a standard.

Following are given approximate scale drawings of twenty examples of table legs. With the aid of a scale, a full-sized setting out can easily be made. A brief description of these table legs is added :

No. 1.—Standard turned dining-table leg, 4 ins. square.

No. 2.—The shaft is reeded and upper portion carved.

No. 3.—Plain turned dining-table oak, mahogany or walnut leg.

No. 4.—Turned and reeded shaft.

No. 5.—Turned with reduced squares, Elizabethan type.

No. 6.—Turned 6 ins. square.

No. 7.—Leg with reduced squares. Elizabethan type.

No. 8.—Ditto. Legs 7 and 8 are shown purely for wood turner. Decoration on the bulb or acorn portions come under the heading of carving.

No. 9.—Modern billiard table leg, 6 ins. square, and left for a 9-in. table framing.

No. 10.—Leg made in two portions to accommodate under framing. Queen Anne type.

No. 11.—Turned as shown, or may be decorated by fluting the shaft.

No. 12.—Modern 4-in. dining-table leg (with full-sized details).

No. 13.—Washstand leg without castor, 2 ins. square (with full-sized details).

No. 14.—Washstand leg with castor if desired (with full-sized details).

No. 15.—Washstand leg with castor if desired. Twisted turning (with full-sized details).

No. 16.—Washstand leg (with full-sized details).

The usual height of washstand to table top is 2 ft. 6 ins.

No. 17.—Occasional table or other small table legs, 2-in. squares.

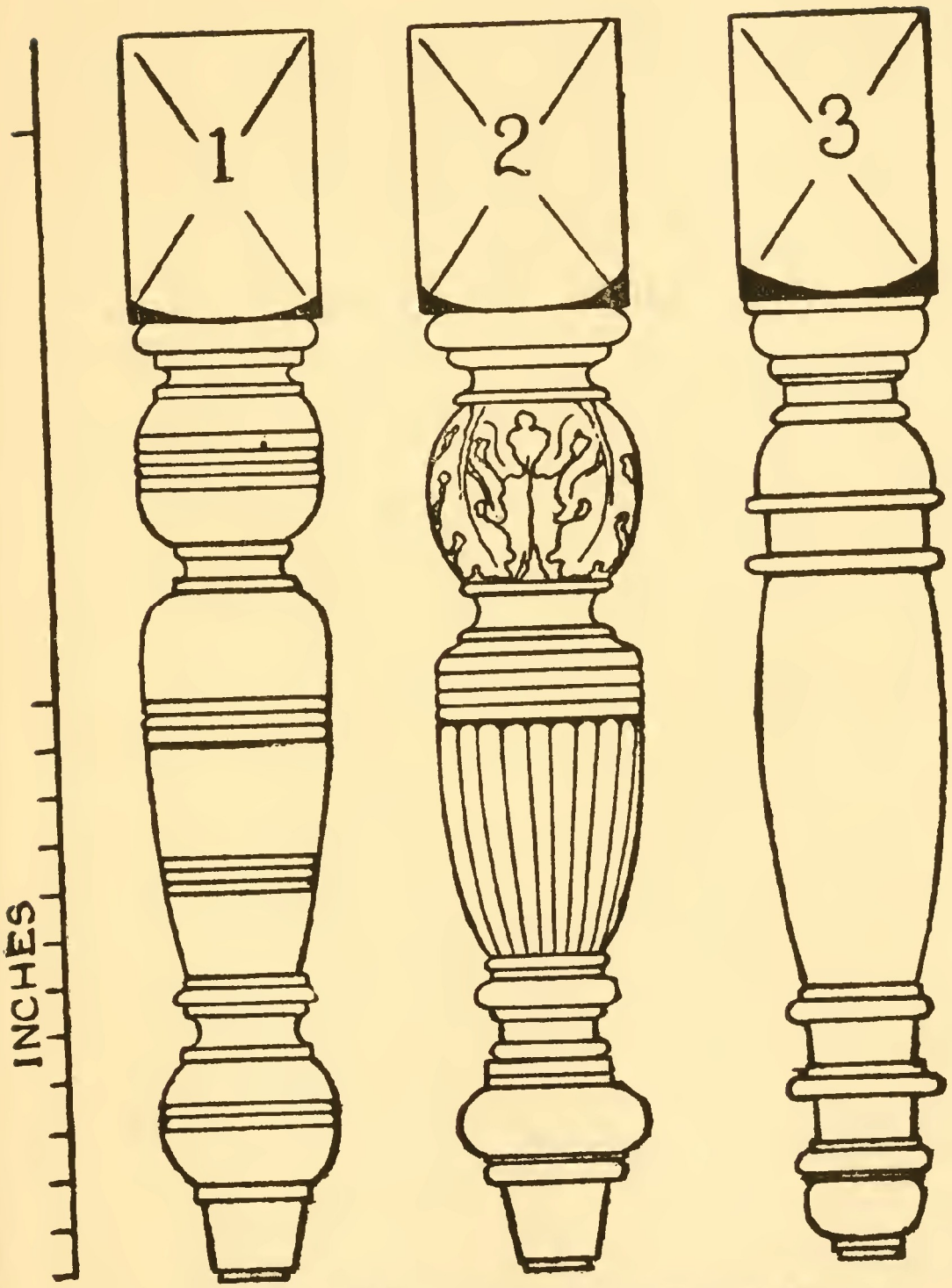
No. 18.—Occasional table or other small table legs, 2-in. squares.

No. 19.—Occasional table or other small table legs, 2-in. squares.

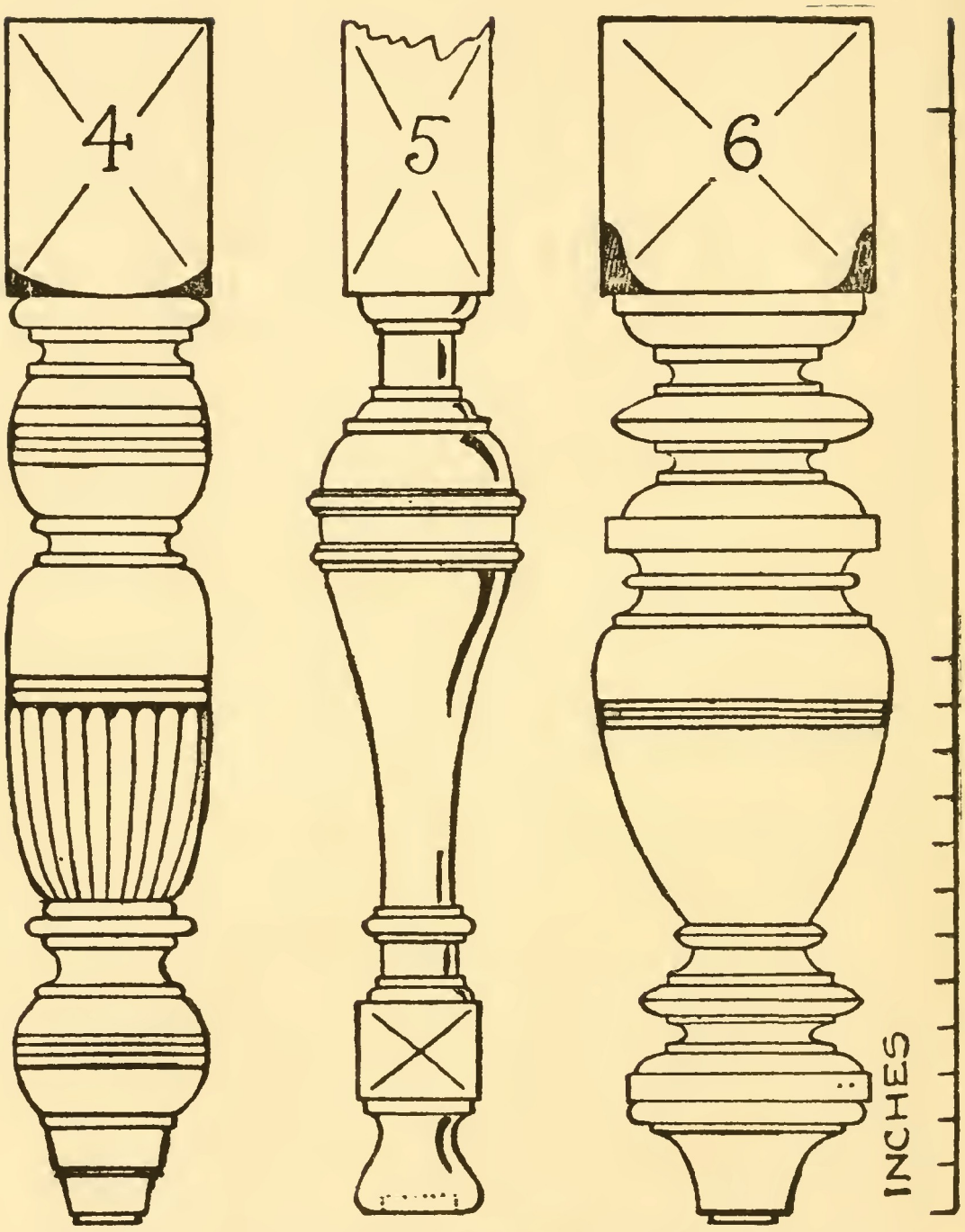
No. 20.—Occasional table or other small table legs, 2-in. squares.

Occasional tables vary in height from 2 ft. 2 ins. to 2 ft. 6 ins., according to style.

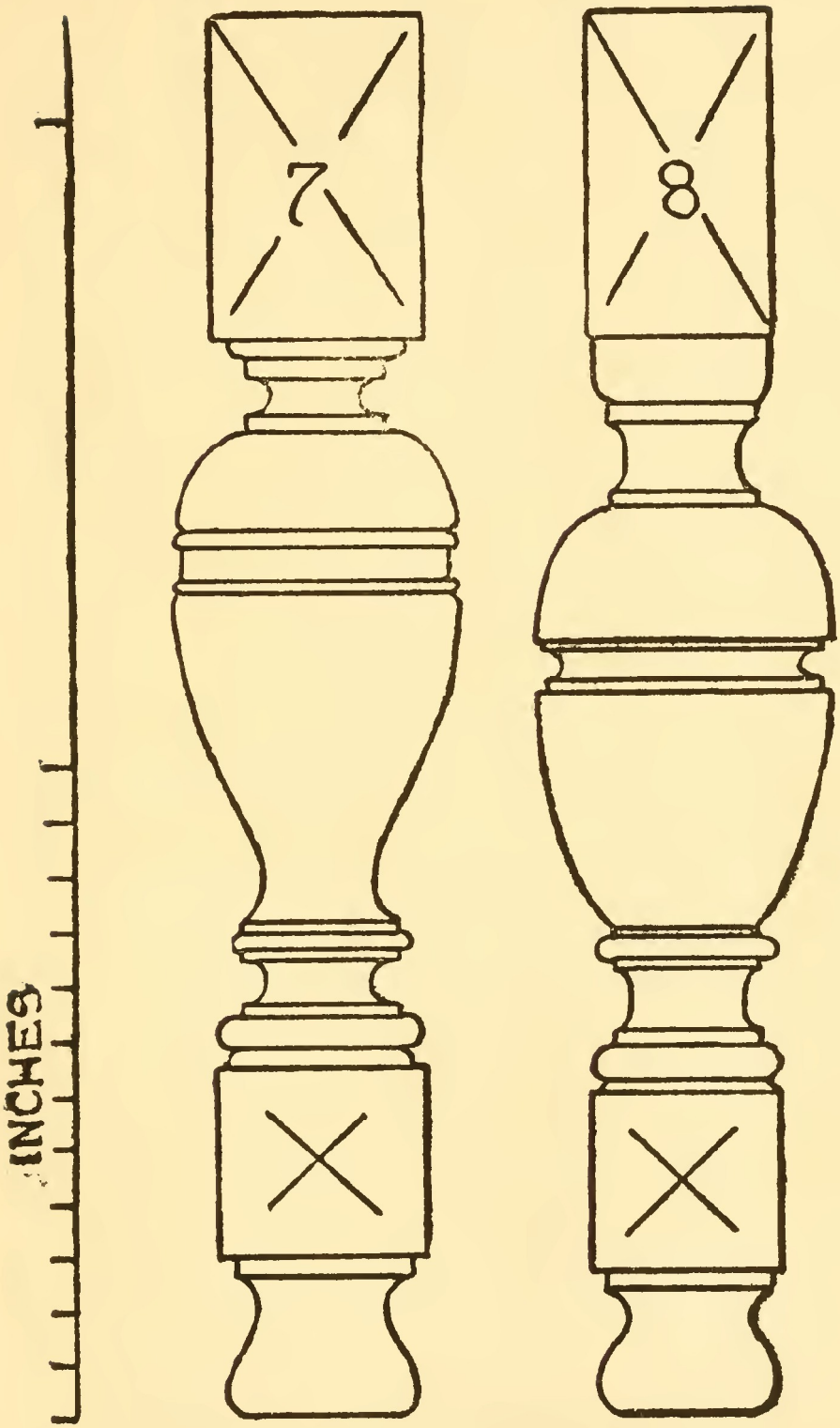
All portions of the legs lettered x on the drawings are left square.



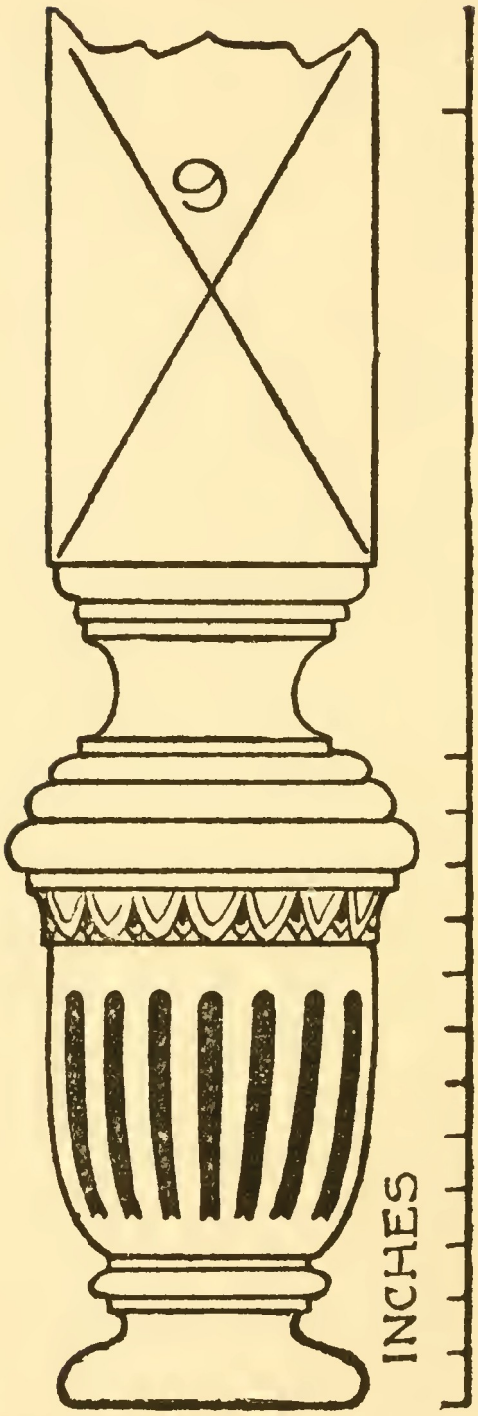
NOS. 1, 2, 3.—PATTERNS OF TURNED DINING-TABLE LEGS.



NOS. 4, 5, 6.—PATTERNS OF TURNED DINING-TABLE LEGS.
(No. 5 has a turned shaft with reduced squares.)

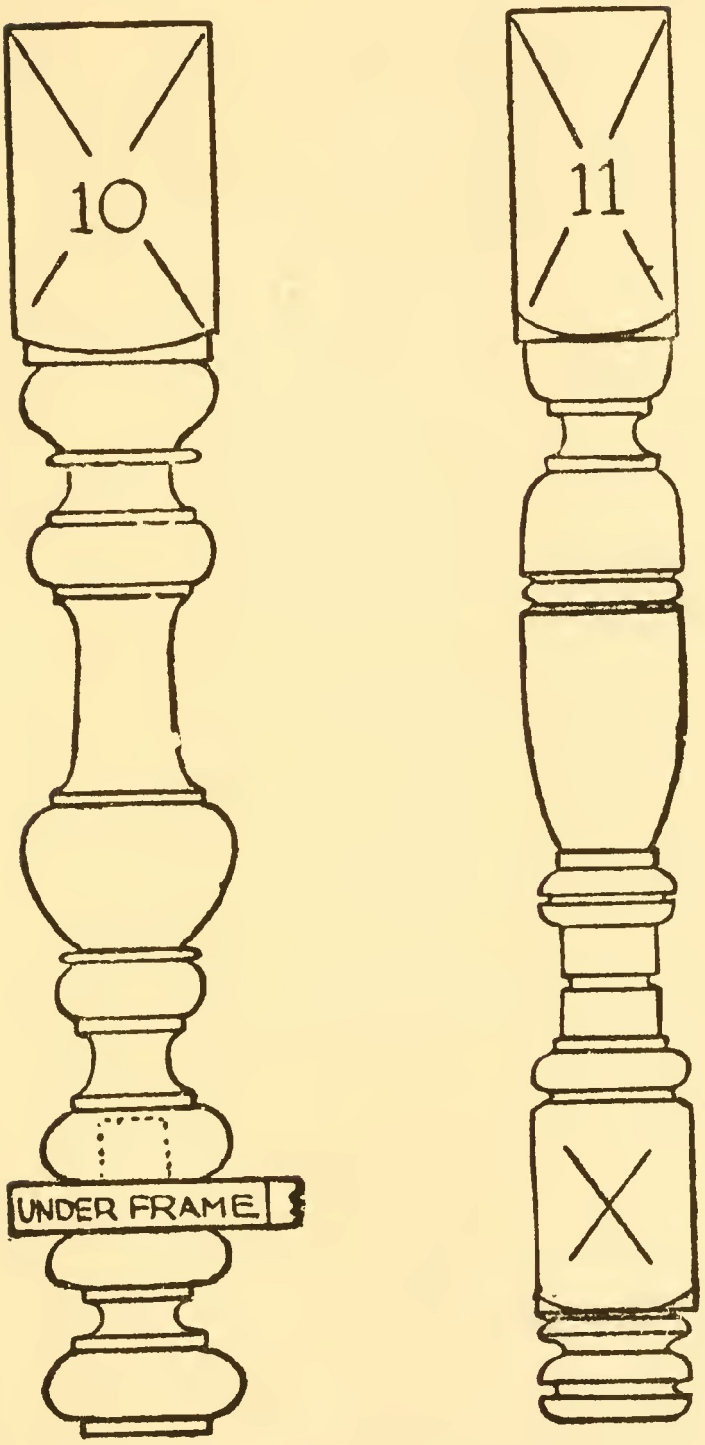


NOS. 7, 8.—ELIZABETHAN PATTERN TABLE LEGS.



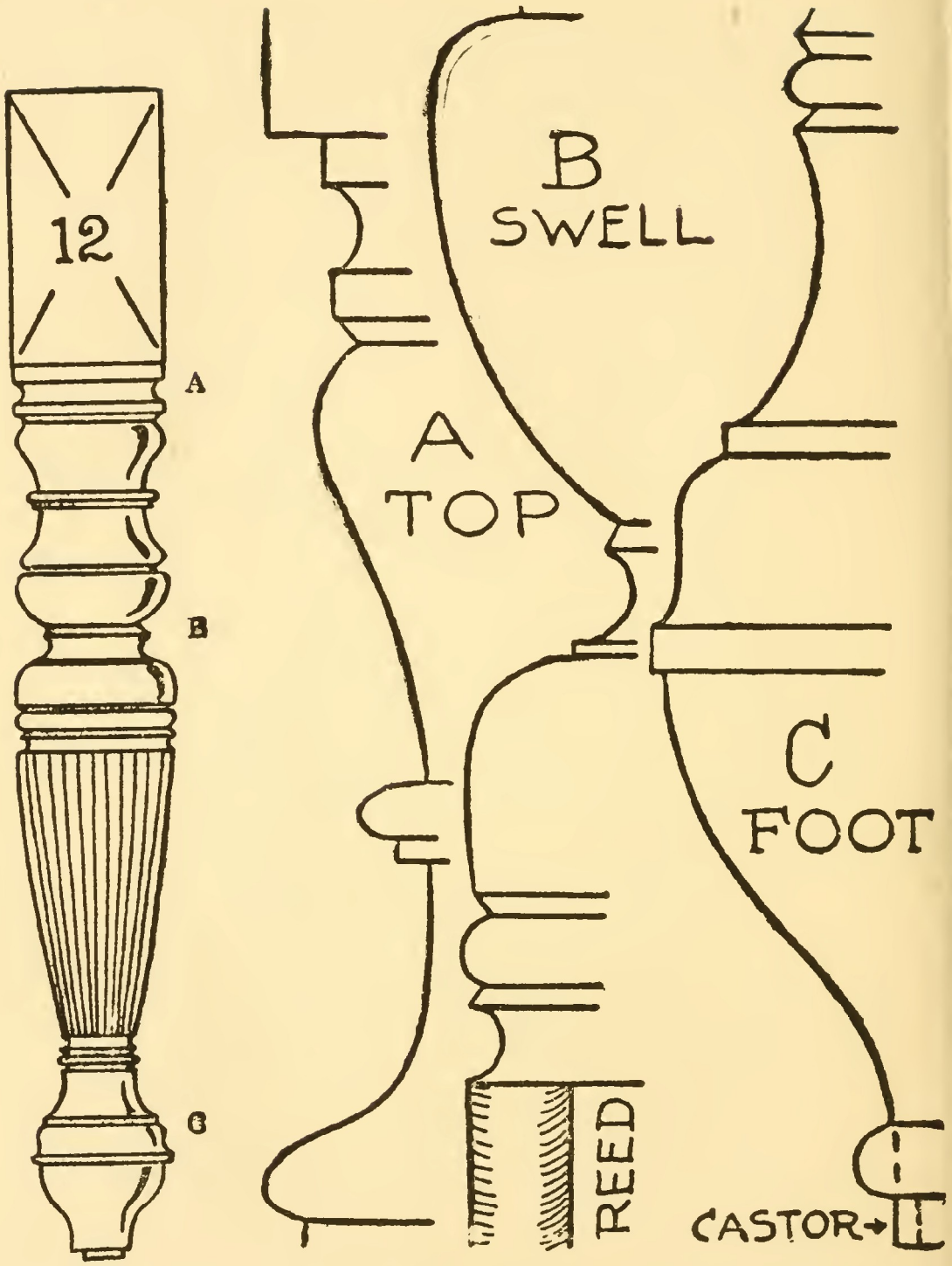
NO. 9.—PATTERN OF BILLIARD TABLE LEG, WITH SCALE.

Legs of large diameter generally have a ¾-in. hole bored lengthways through them to facilitate drying and prevent checking of the timber. The holes are afterwards plugged up.



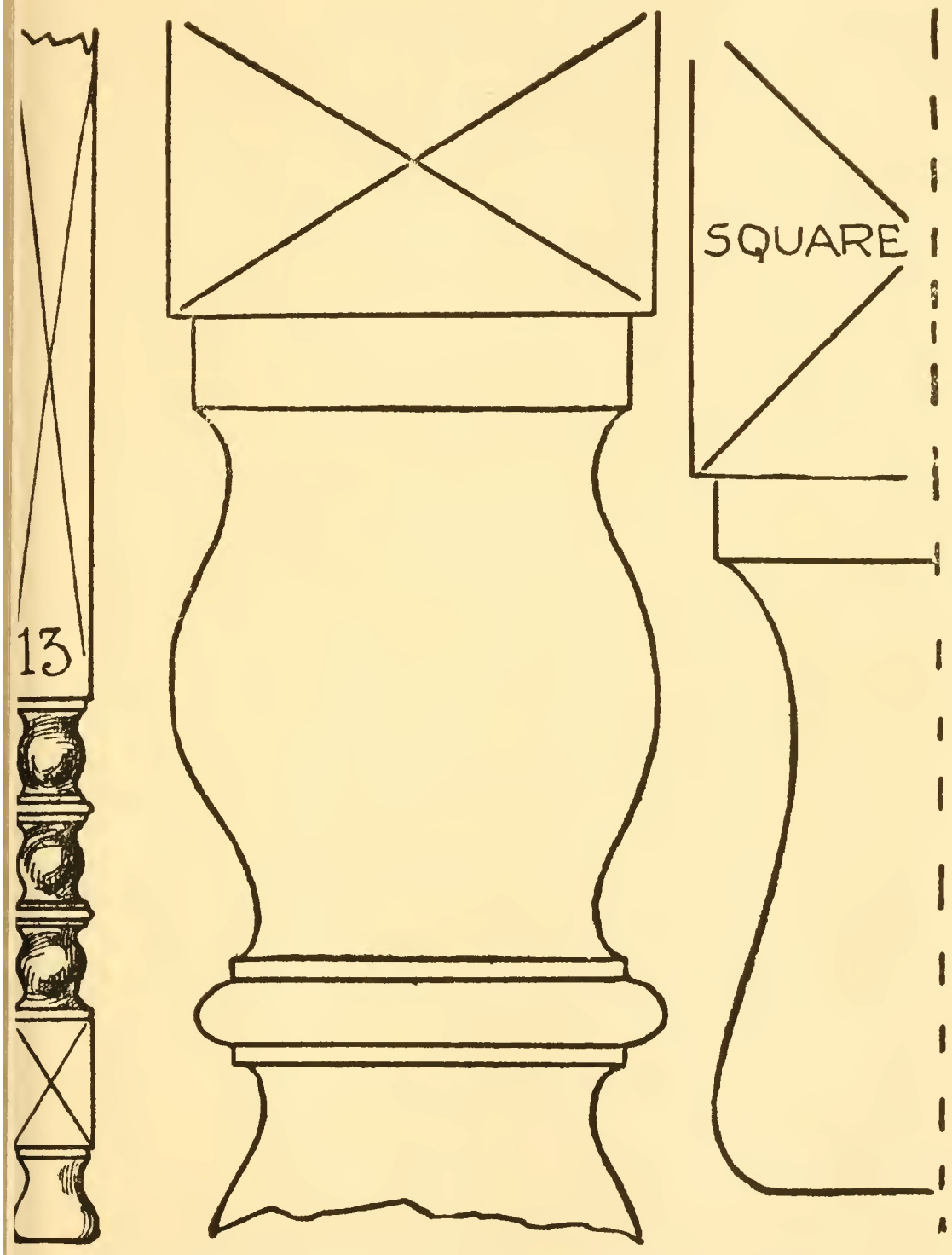
NOS. 10, 11.—PATTERNS OF TABLE LEGS, DESIGNED TO ACCOMMODATE UNDERFRAMING.

Note.—Dotted line of turned pin to make the joint.

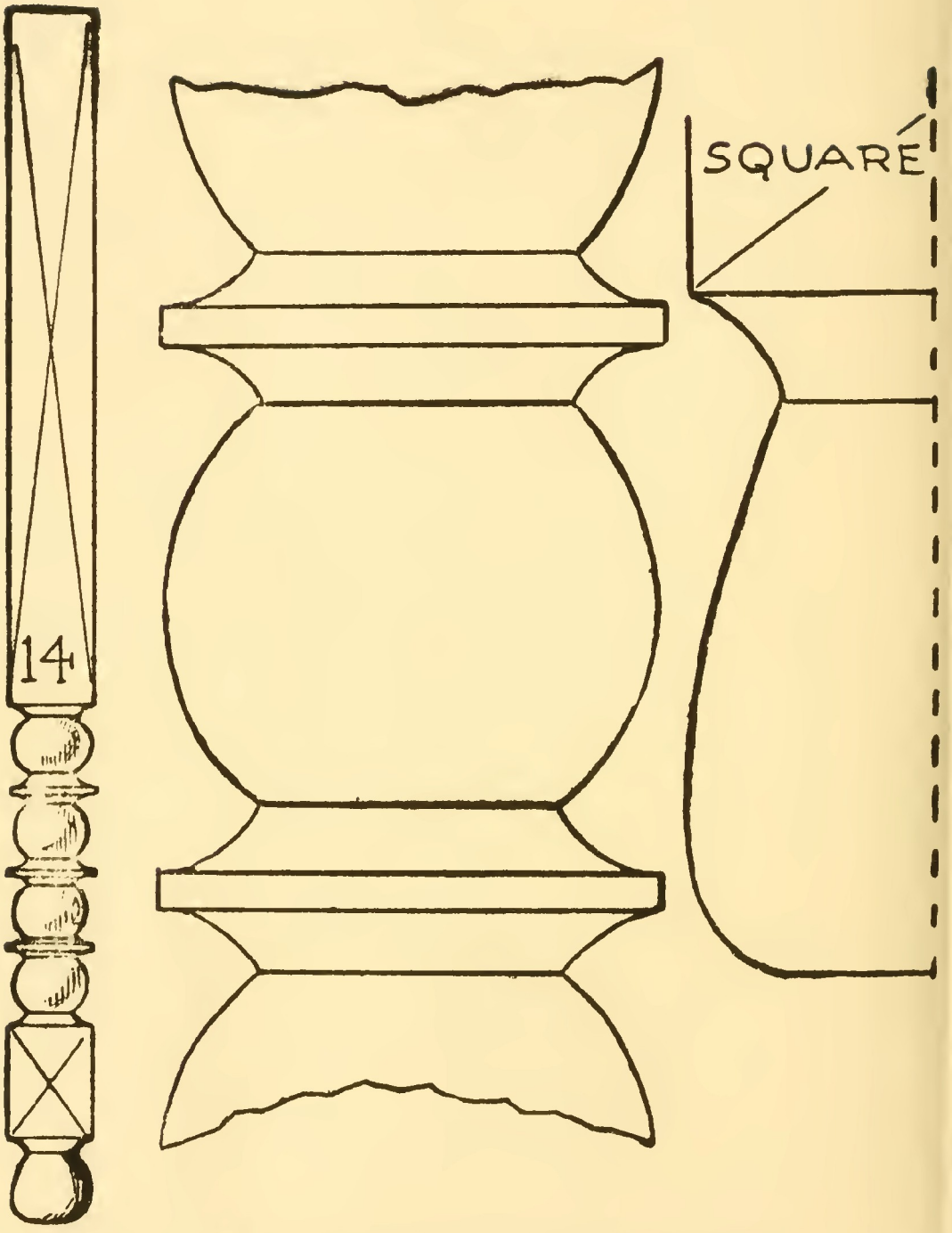


NO. 12.—FOUR-INCH DINING-TABLE LEG (MODERN) WITH FULL-SIZED DETAILS.

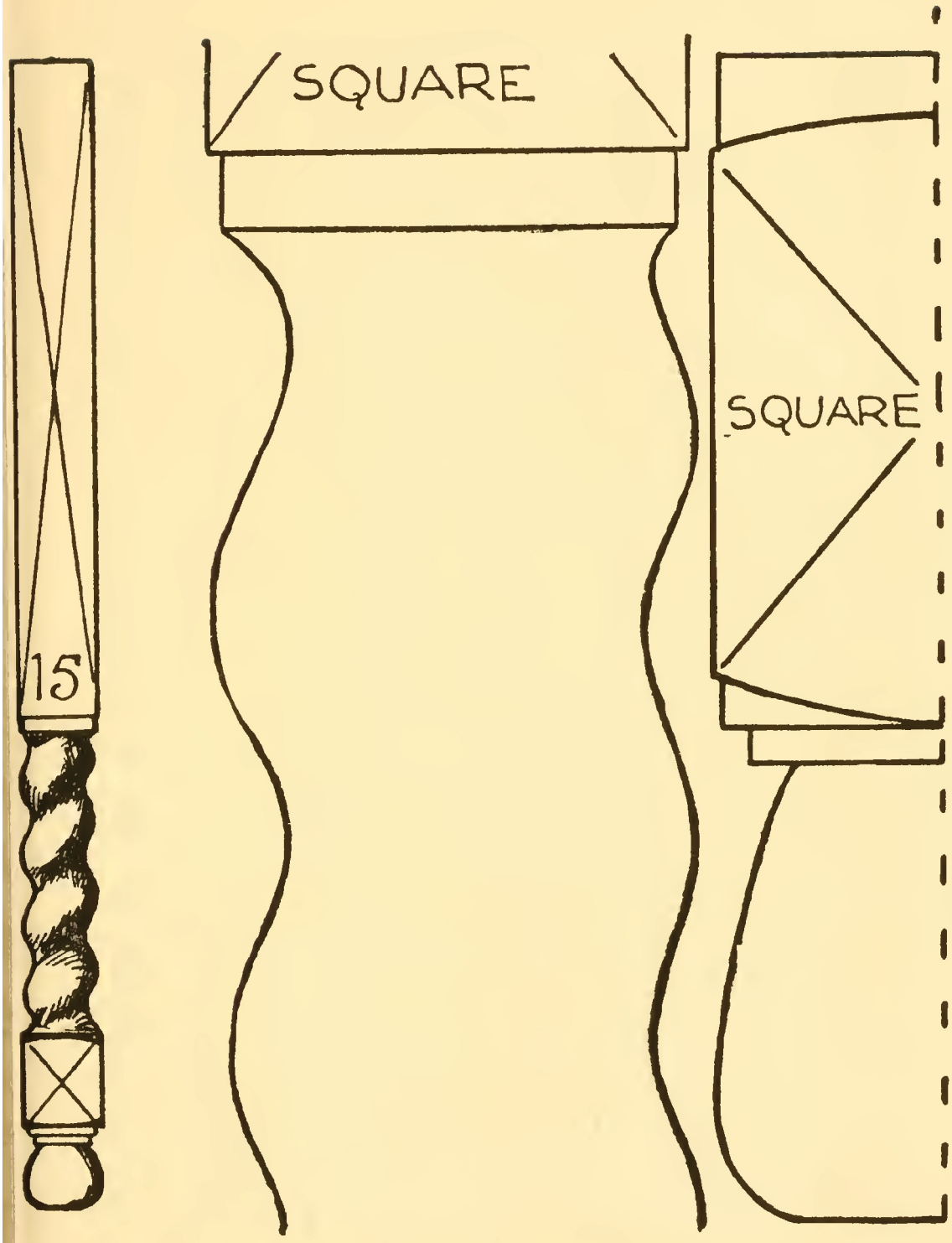
Alternative finish to castor ring is given in full-sized detail.



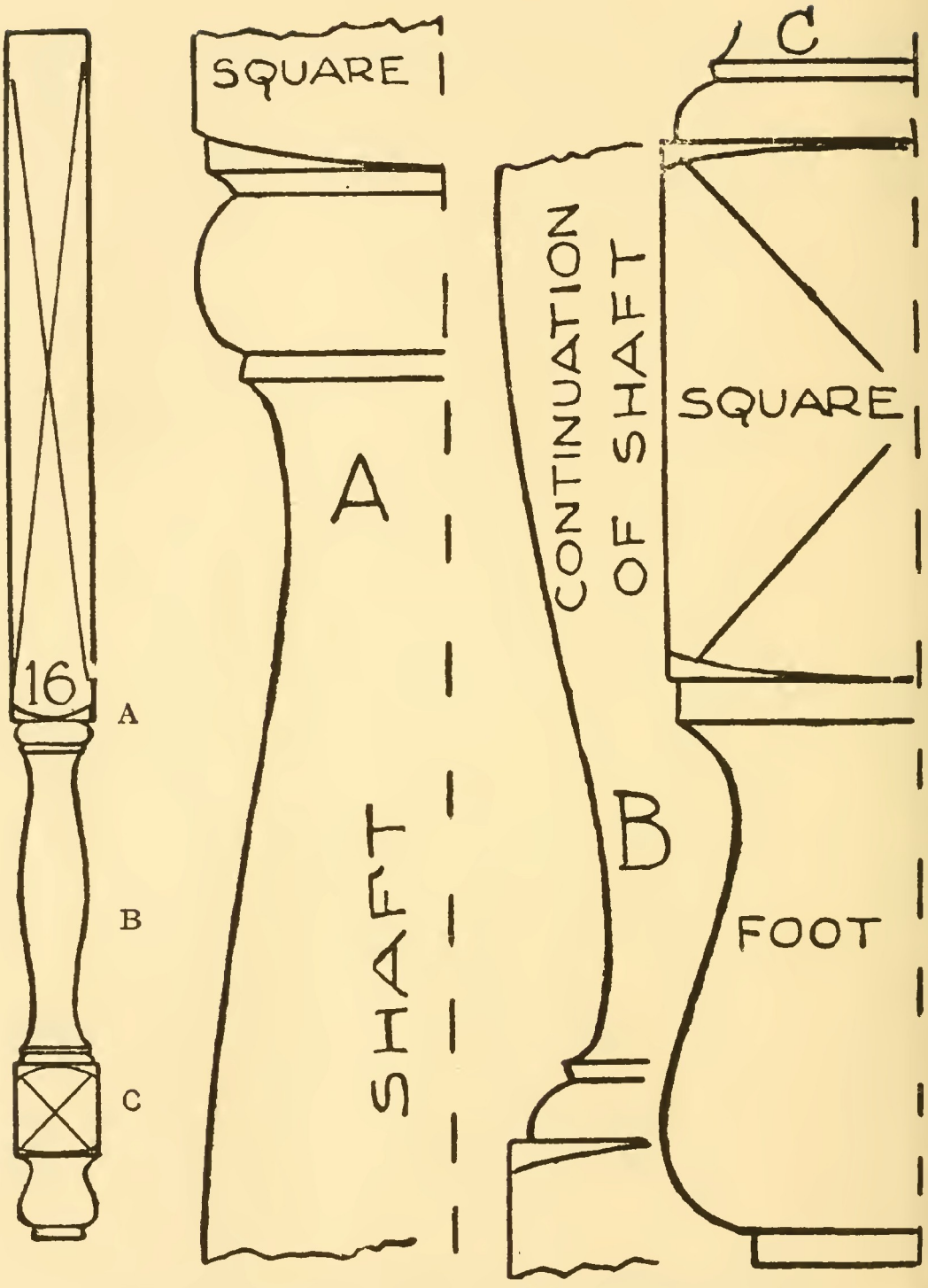
NO. 13.—WASHSTAND LEG, WITH FULL-SIZED DETAILS.



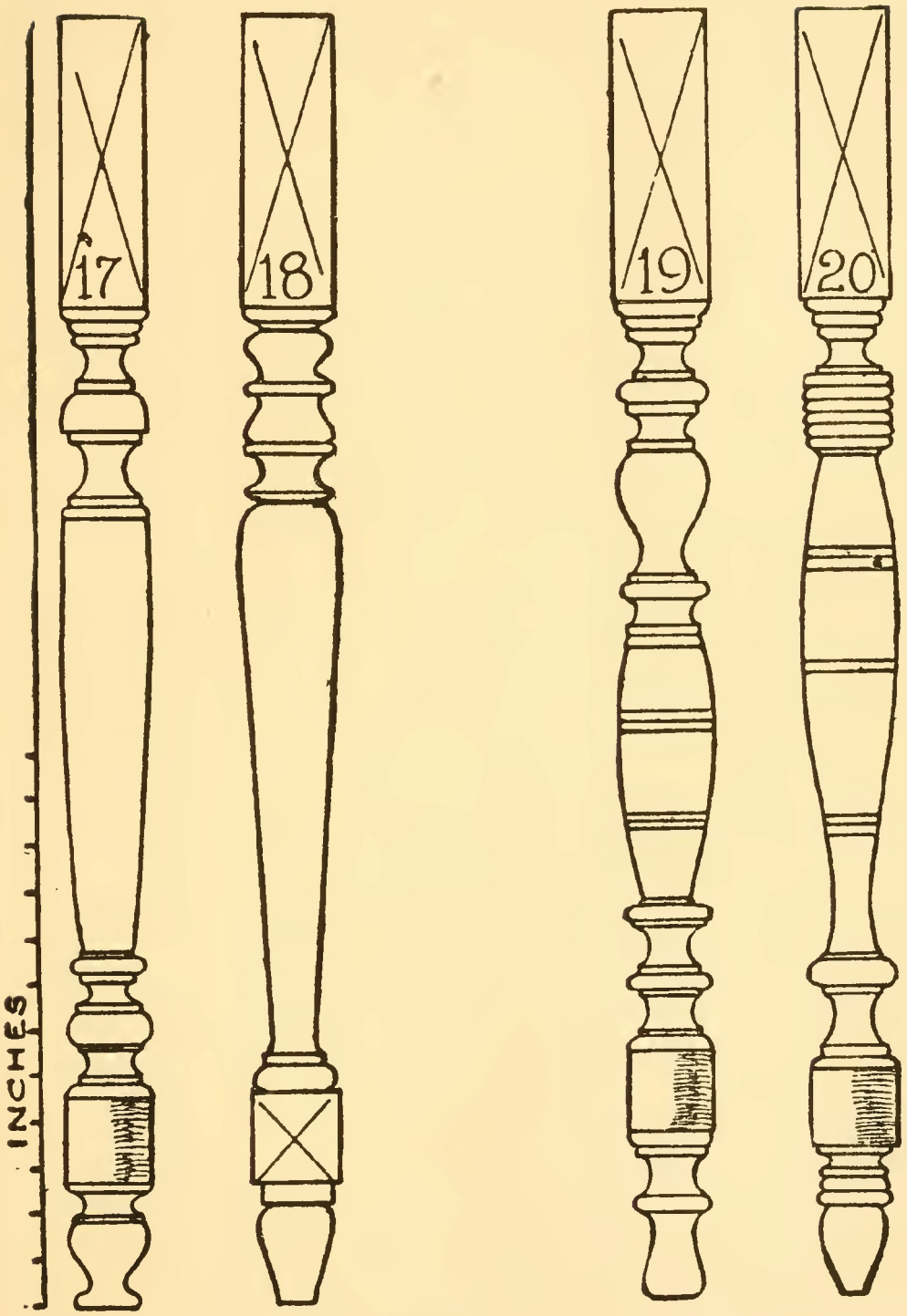
NO. 14.—WASHSTAND LEG, WITH FULL-SIZED DETAILS.



NO. 15.—WASHSTAND LEG, WITH FULL-SIZED DETAILS.



NO. 16.—WASHSTAND LEG, WITH FULL-SIZED DETAILS.



NOS. 17, 18, 19, 20.—TURNED LEGS FOR OCCASIONAL TABLES.

Miscellaneous Patterns for Turning.—The following plates illustrate hall stand, columns, spindles, ornaments, sideboard and overmantel columns, chair legs, chessmen and examples of household turnery.

No. 21.—Column for shop shelves, 1½ ins. to 2 ins. square (with full-sized details).

No. 22—Turned post for hall stand, height about 2 ft. 8 ins. (with full-sized details).

No. 23.—Turned post for hall stand, height about 2 ft. 8 ins. (with full-sized details).

No. 24.—Spindle design for light trap, etc., up to 10 ins. long.

No. 25.—Spindle design for garden gate up to 8 ins. long.

Nos. 26, 27, 28. Chair or couch spindles ; also suitable for galleries around overmantels or sideboards.

Nos. 29, 33, 34.—Ornaments for general work, such as tops of chairs, cabinets, fire screens.

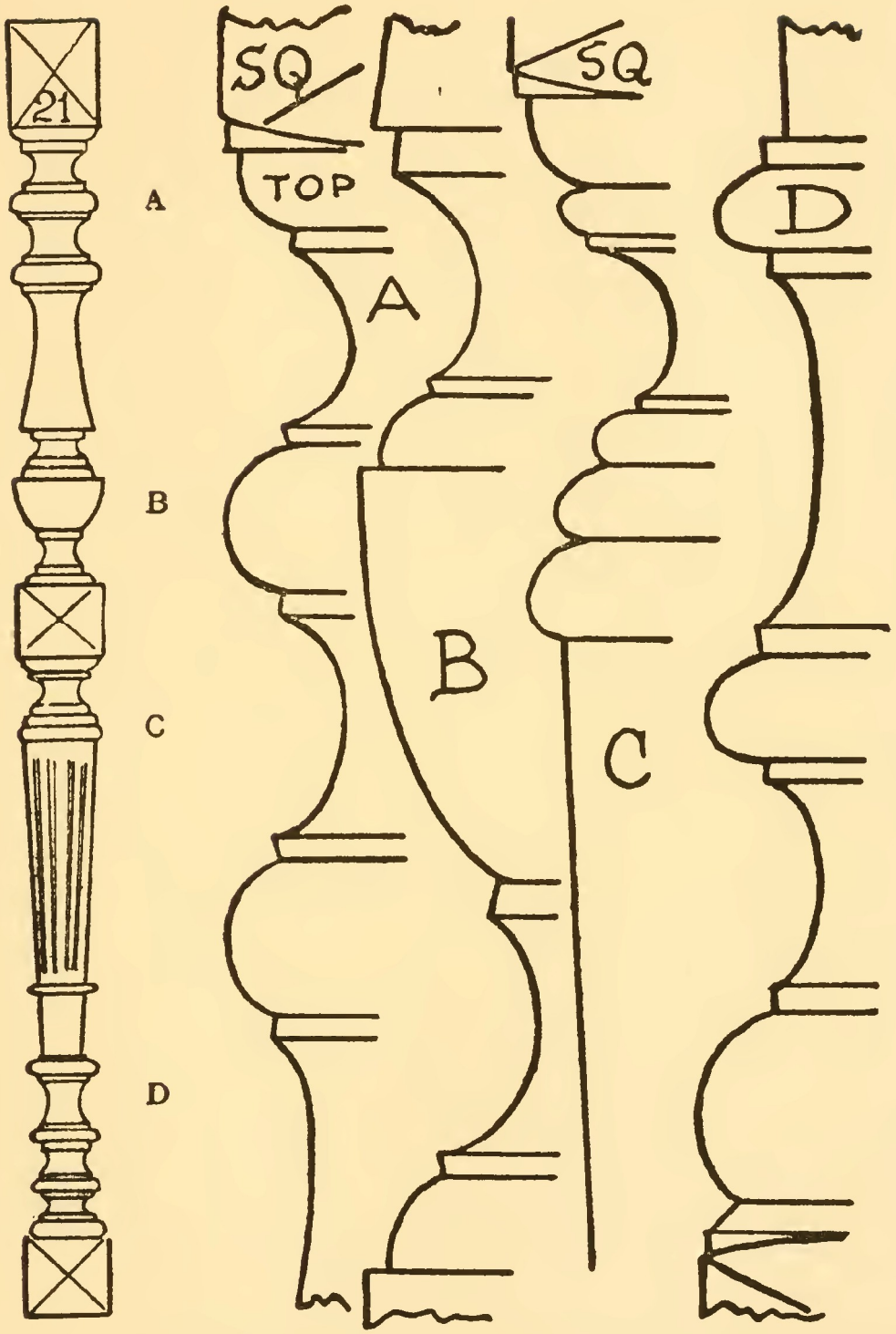
Nos. 30, 31, 32.—Furniture buttons for hiding the heads of screws used for constructional purposes.

No. 35.—Method of applying same to the work.

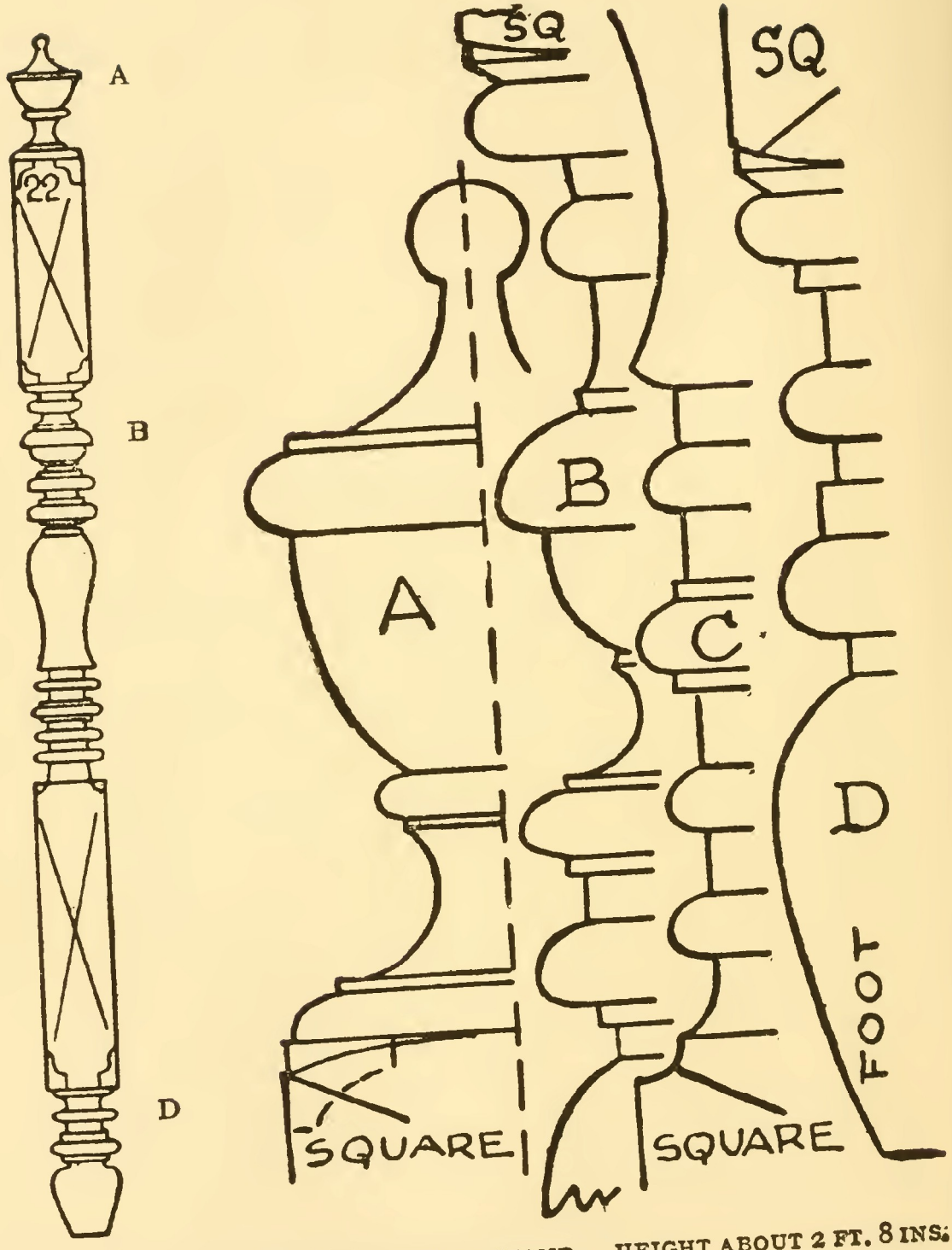
Nos. 36 37, 38, 39.—Ornamental turning. After turning ropes of the desired pattern they are cut in half lengthways so as to be glued on to the work. Occasionally they are sawn lengthways into four pieces, so as to enable them to be glued into a rebate. No. 38 is pearl beading.

No. 40.—Two finials for a barge board at the apex of the roof of a house. Also suitable for a flagstaff.

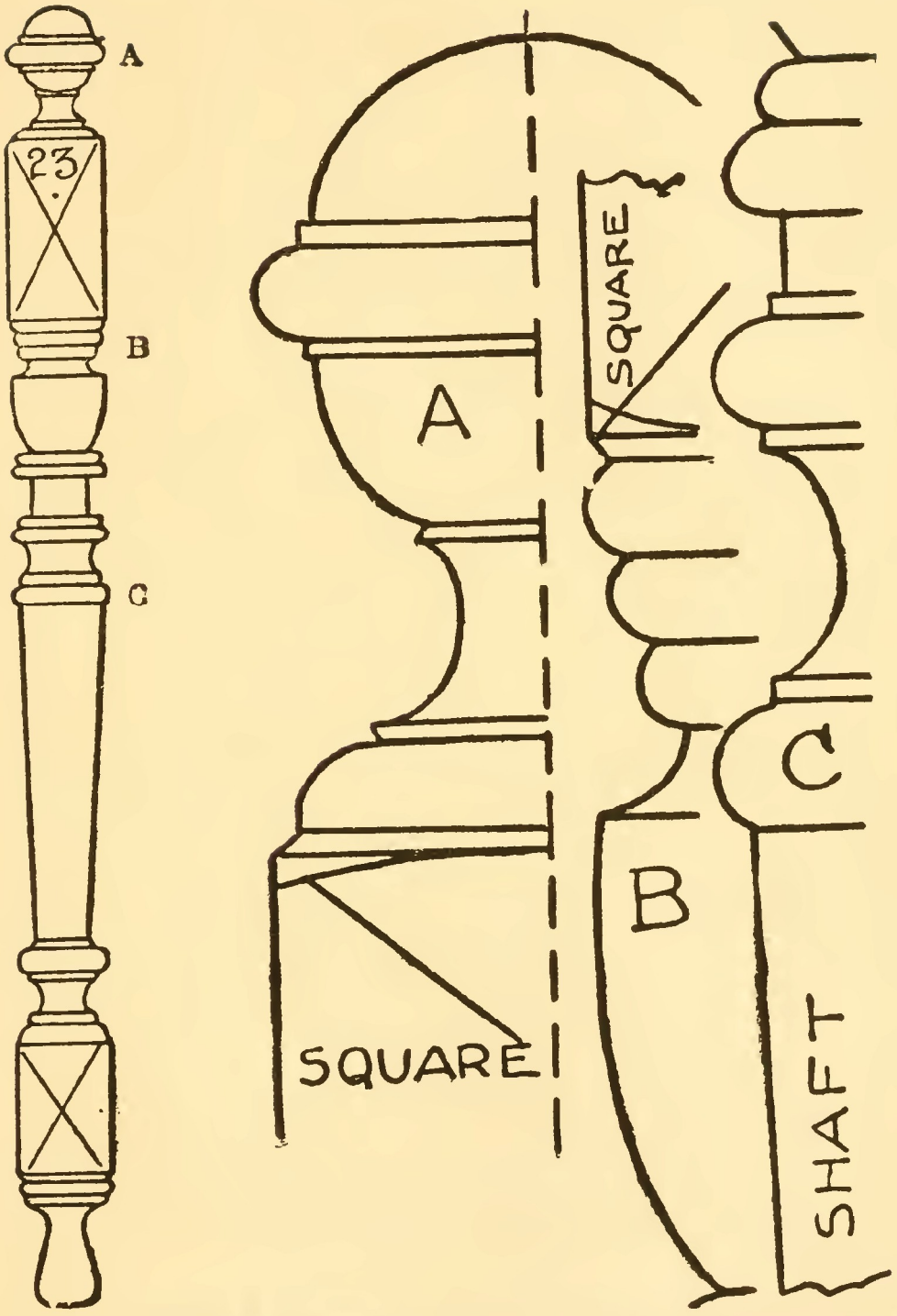
Other examples of turnings are given on pp. 127 and 128 (sideboard columns), 129 (chair legs), 130 (table leg, full-sized details), 131 (newel posts), 132 (household turnery), and 134 (chessmen)



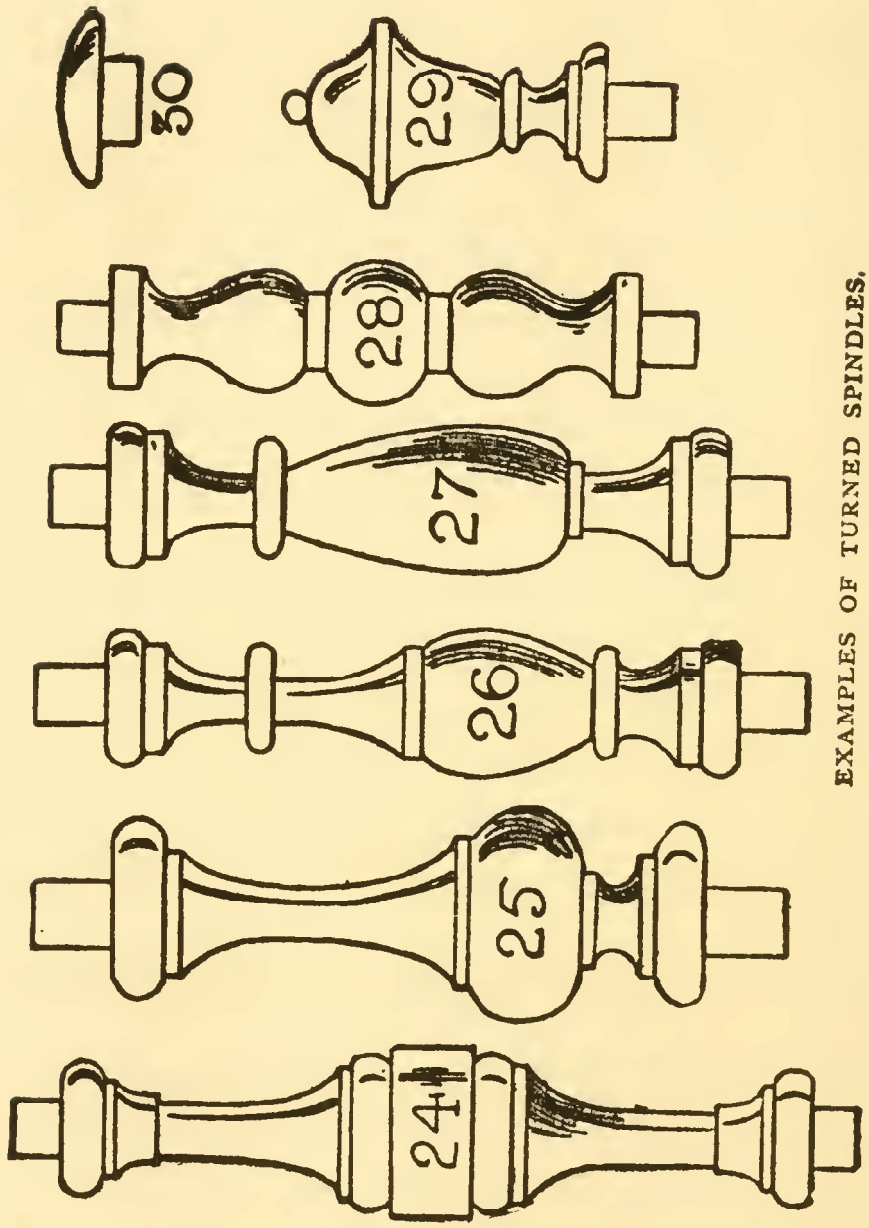
NO. 21.—COLUMN FOR SHOP SHELVES, 1½ INS. TO 2 INS. SQUARE, WITH FULL-SIZED DETAILS.



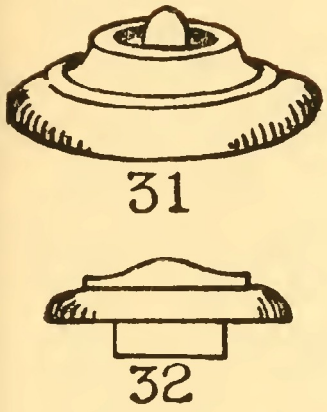
NO. 22.—TURNED POST FOR HALL STAND. HEIGHT ABOUT 2 FT. 8 INS. WITH FULL-SIZED DETAILS.



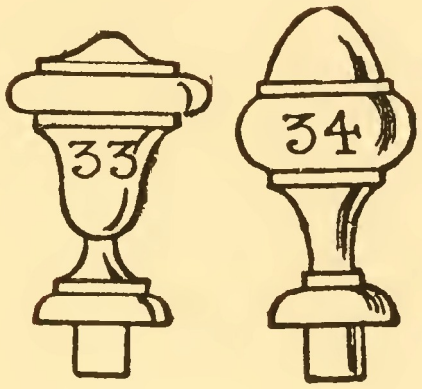
NO. 23.—TURNED POST OF HALL STAND. HEIGHT ABOUT 2 FT. 8 INS. WITH FULL-SIZED DETAILS. (DETAILS OF FOOT NOT SHOWN.)



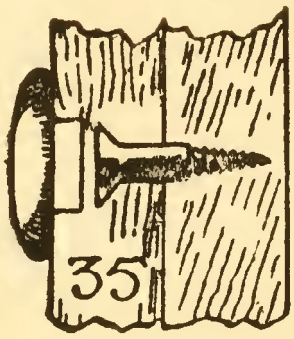
EXAMPLES OF TURNED SPINDLES.



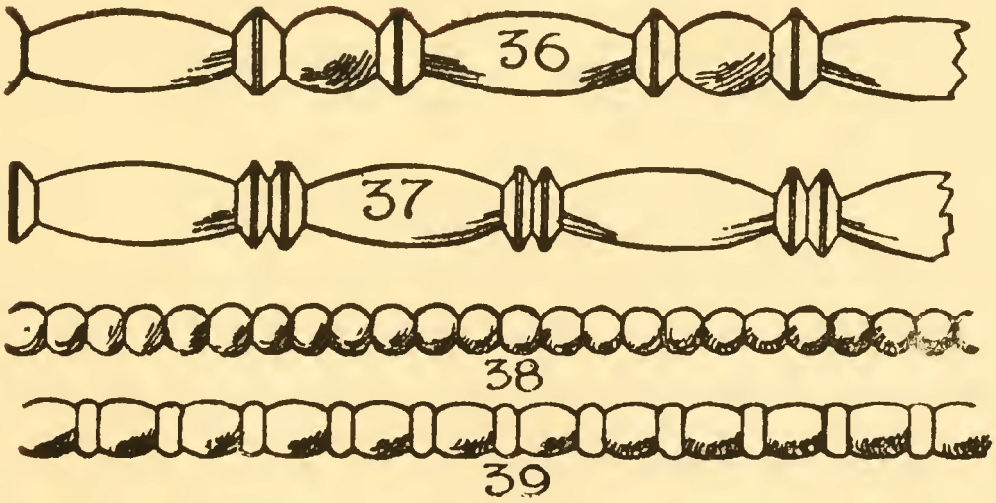
FURNITURE BUTTONS.



TERMINAL ORNAMENTS.

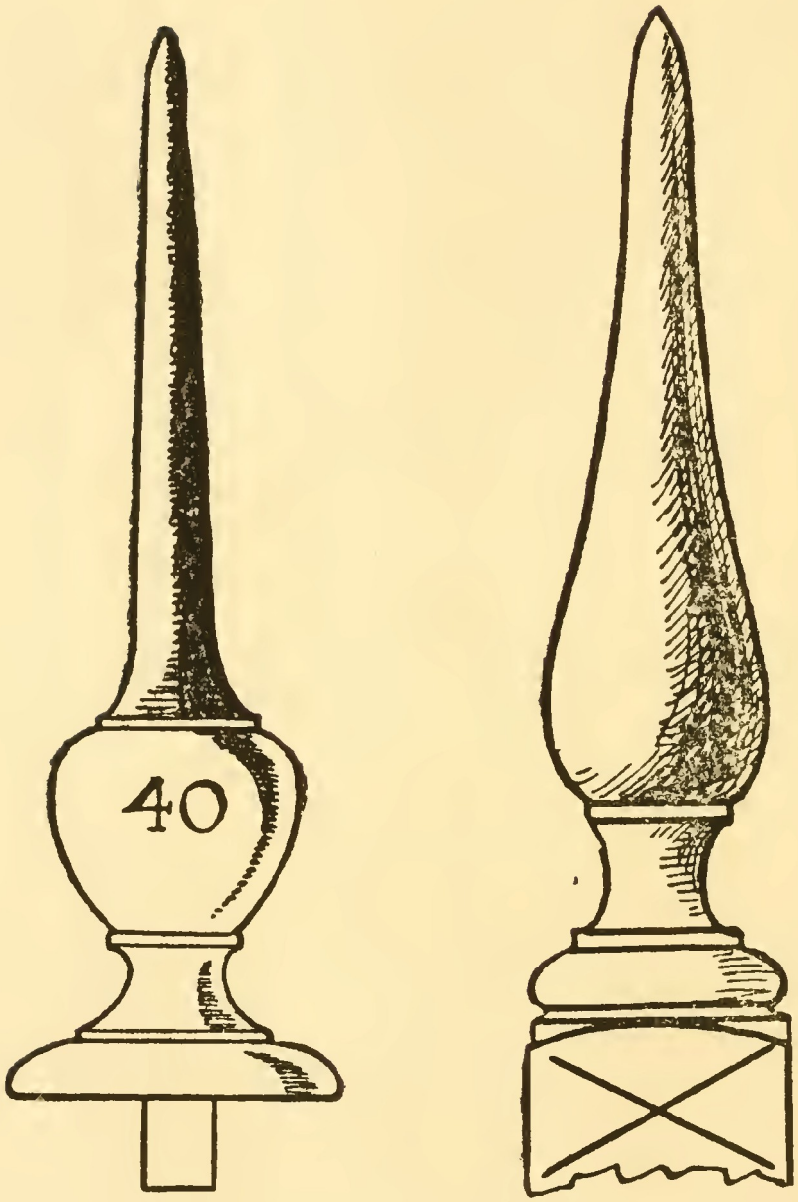


FIXING A TURNED BUTTON.

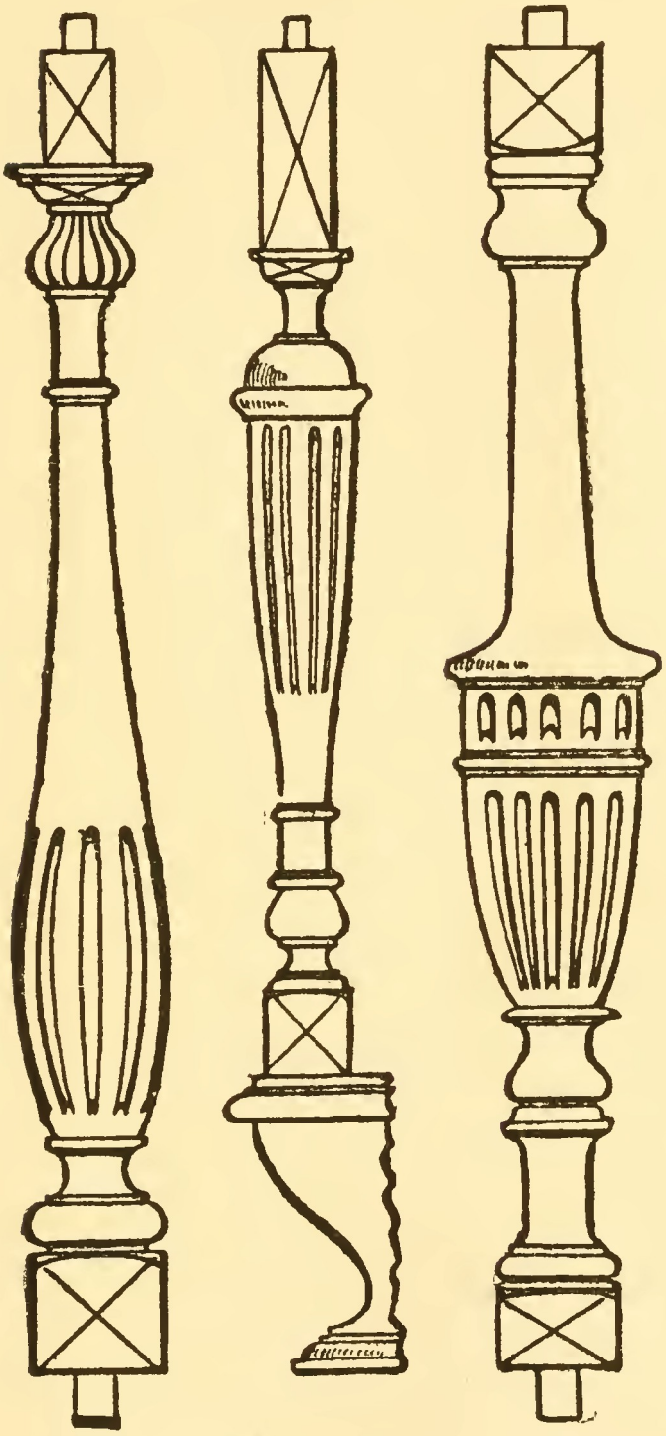


EXAMPLES OF ORNAMENTAL TURNING.

These are used round, half-round, and quarter-round.

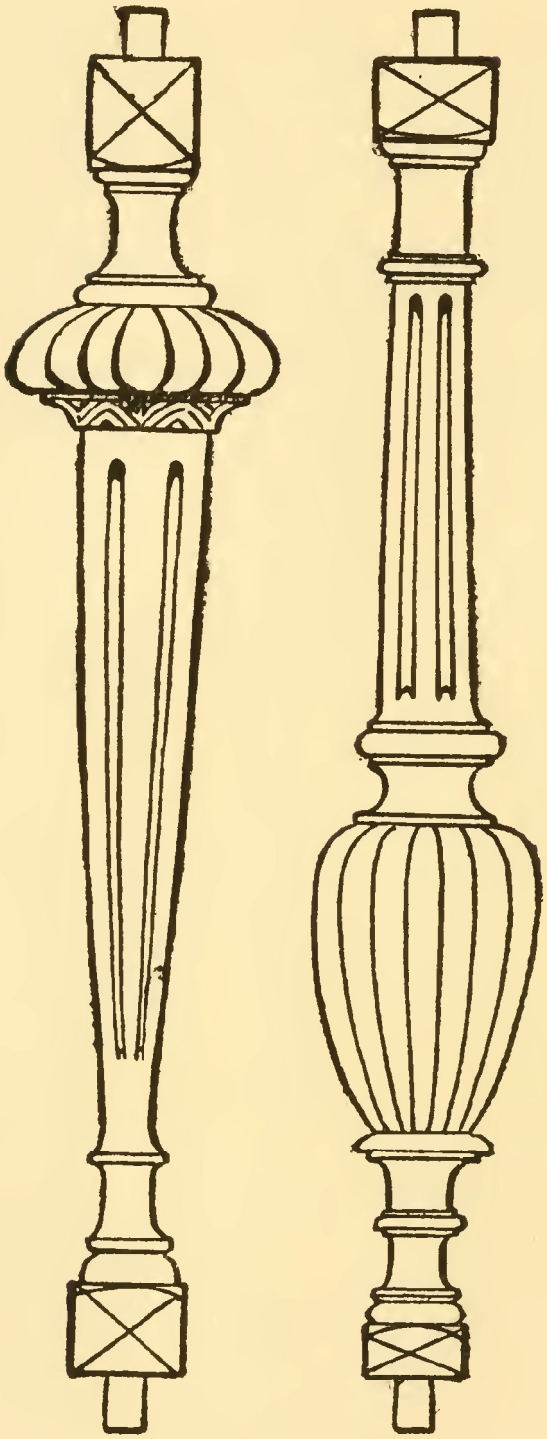


FINIALS FOR BARGEBOARD, A TERMINAL FOR FLAGSTAFF.

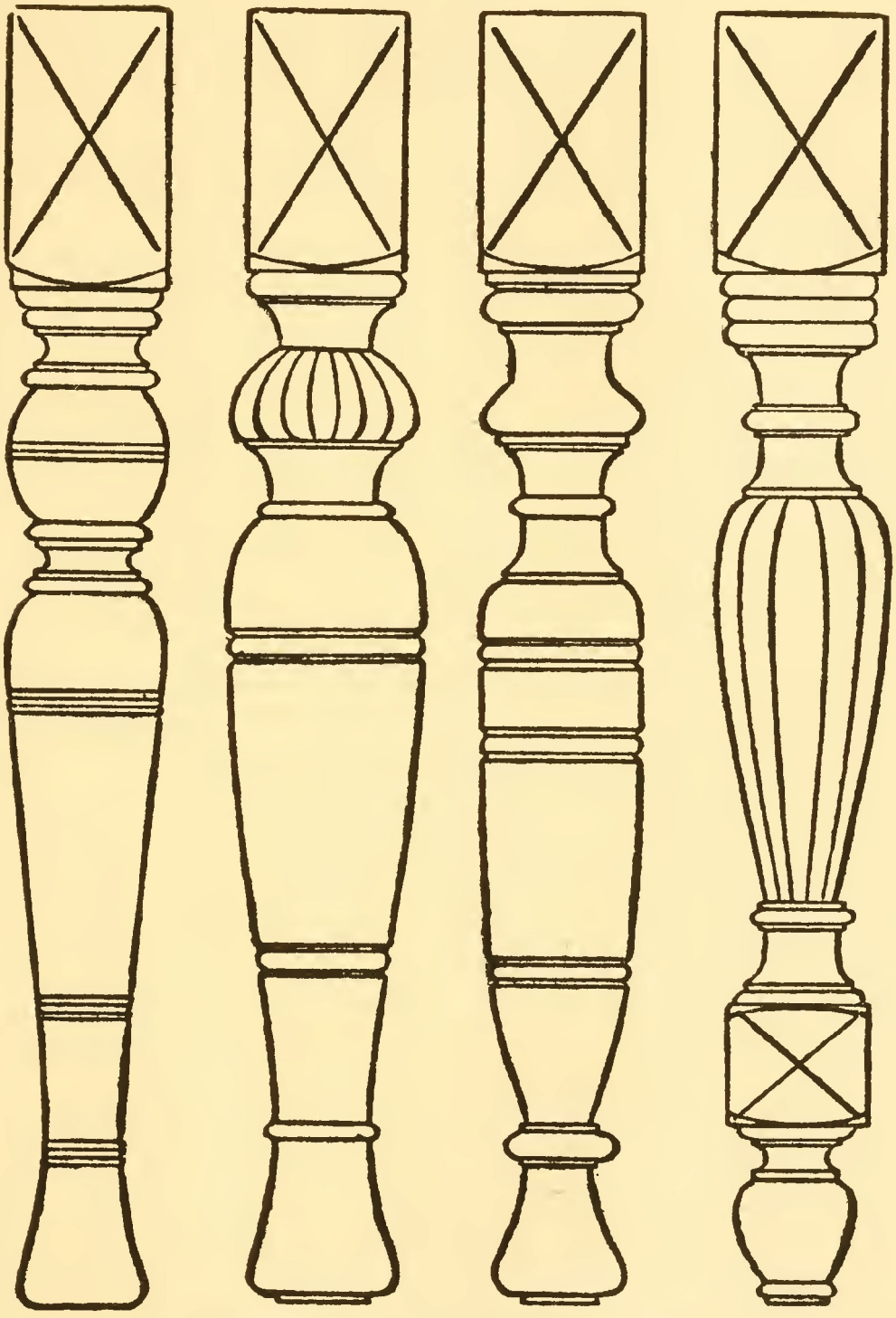


EXAMPLES OF SIDEBOARD COLUMNS.

Heights to suit sideboard backs. General height, 2 ft. 2 ins. to 2 ft. 3 ins.

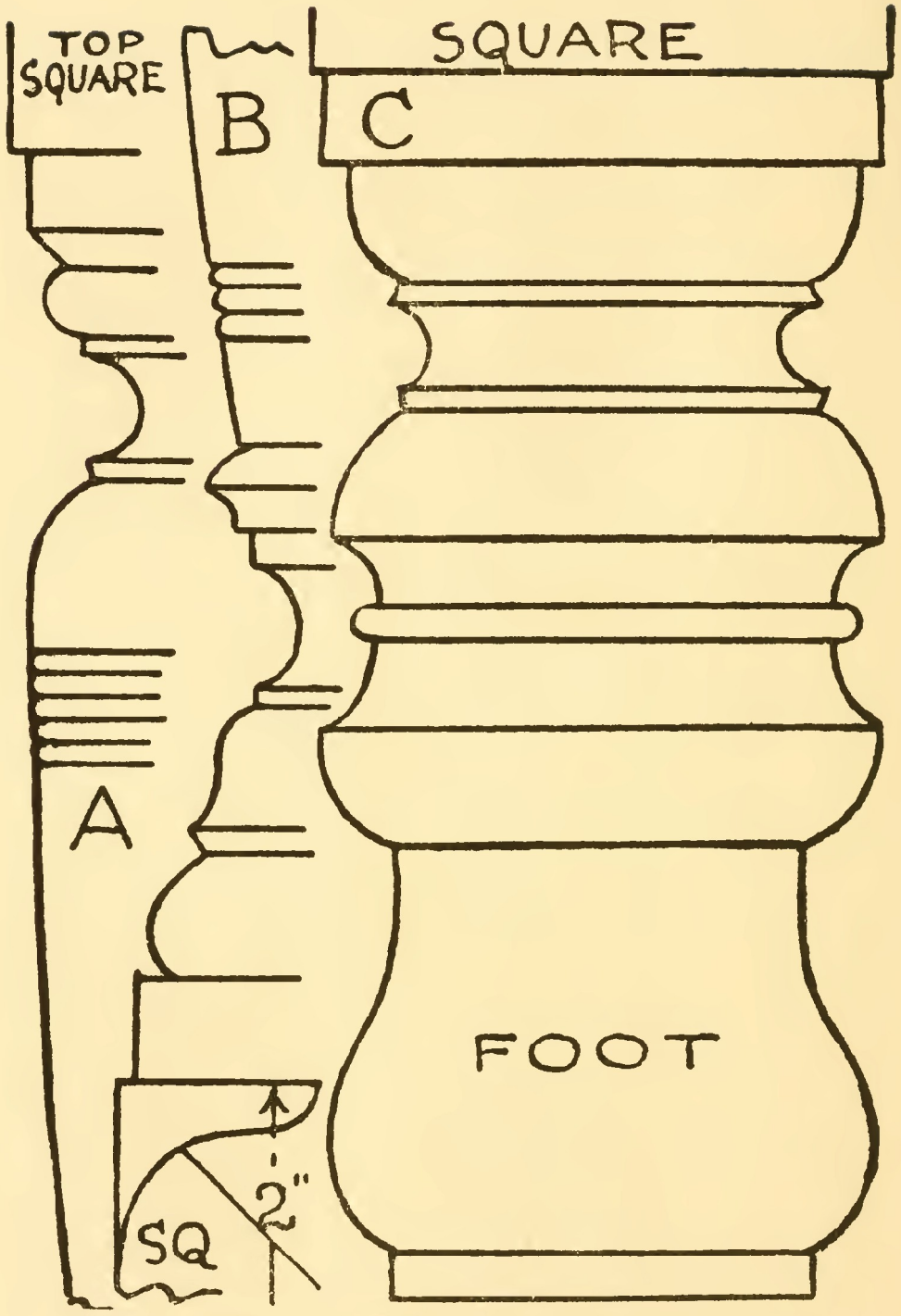


EXAMPLES OF SIDEBOARD OR OVERMANTEL COLUMNS.
Heights to suit requirements. General height,
2 ft. 2 ins.



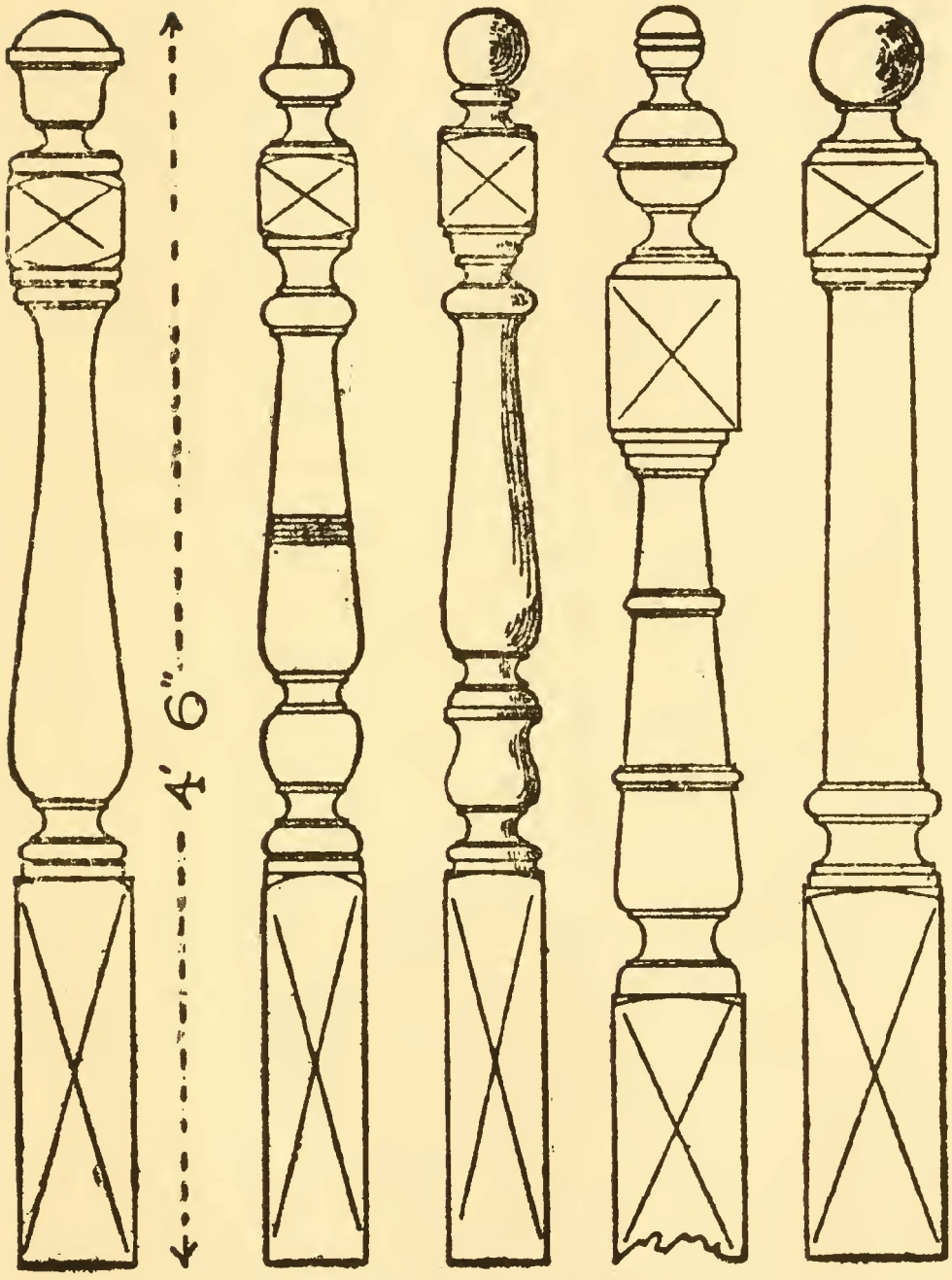
EXAMPLES OF TURNED CHAIR LEGS.

General height to top of frame for upholstered seats, 17 ins.



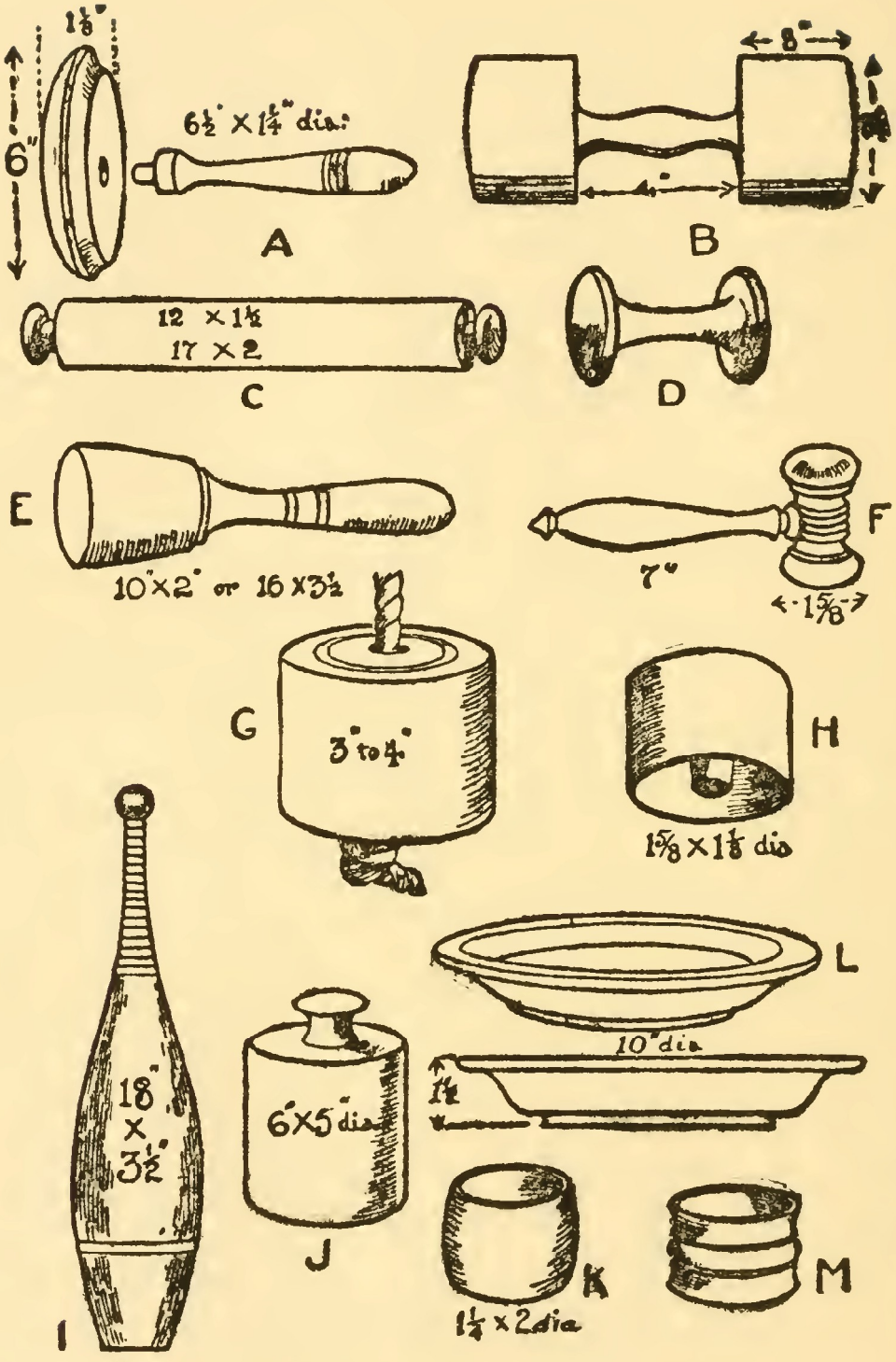
FULL-SIZE DETAILS OF A WASHSTAND OR OCCASIONAL TABLE LEG.

Length of turning, 14 ins. long. Lower square portion, 2 ins. high.



EXAMPLES OF TURNED NEWEL POSTS.

General Dimensions, 4 ins. to 6 ins. diameter.



EXAMPLES OF HOUSEHOLD TURNERY.

Household Turnery.—A few examples of useful household turnery are given opposite. The general sizes are marked, and modifications to suit existing requirements may be made by the worker.

A.—Vegetable presser, or butter worker. A suitable wood is sycamore, maple, holly, box, beech, or birch.

B.—Dumbells, made of birch ; the ends bored and weighted with lead according to requirements.

C.—Rolling pin, alternative sizes being given on sketch. A suitable wood is sycamore, maple, birch, or box.

D.—Reel for builder's chalk line ; size to own requirements. Use boxwood, sycamore, or other hard and close-grained wood.

E.—Potato masher : two sizes given on sketch. Made of maple, sycamore, or birch.

F.—Chairman's or auctioneer's mallet. Length of handle, 7 ins. Suitable wood is ebony or English walnut.

G.—Halter block for stable use, 3 ins. to 4 ins. diameter, and about 4 ins. to 5 ins. long ; oak or beech.

H.—Soda water bottle opener ; boxwood.

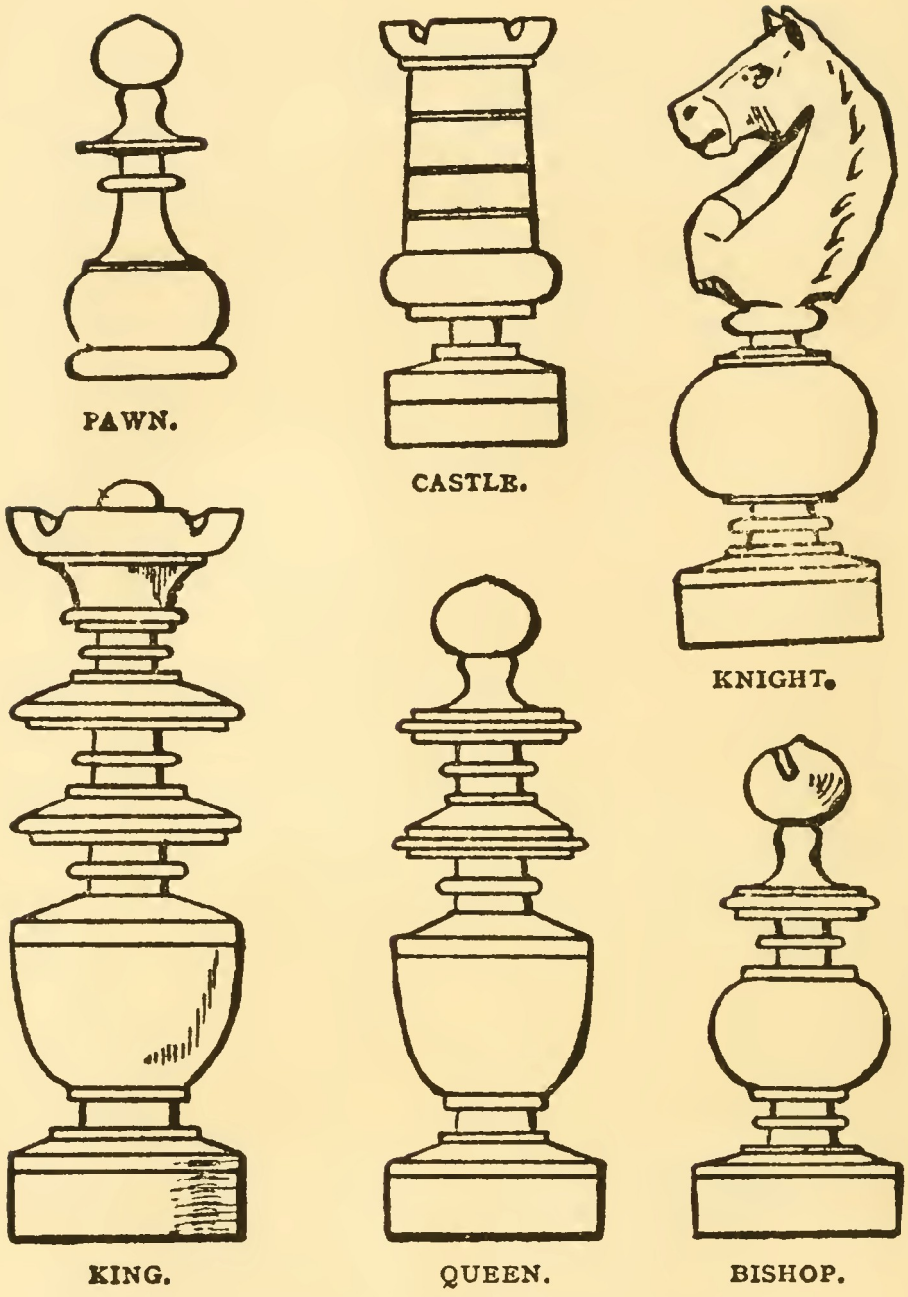
I.—Indian club (adult's size) ; birch wood.

J.—Pork pie block, for assisting to raise the pastry ; birch, beech, or sycamore.

K.—Plain serviette ring ; boxwood.

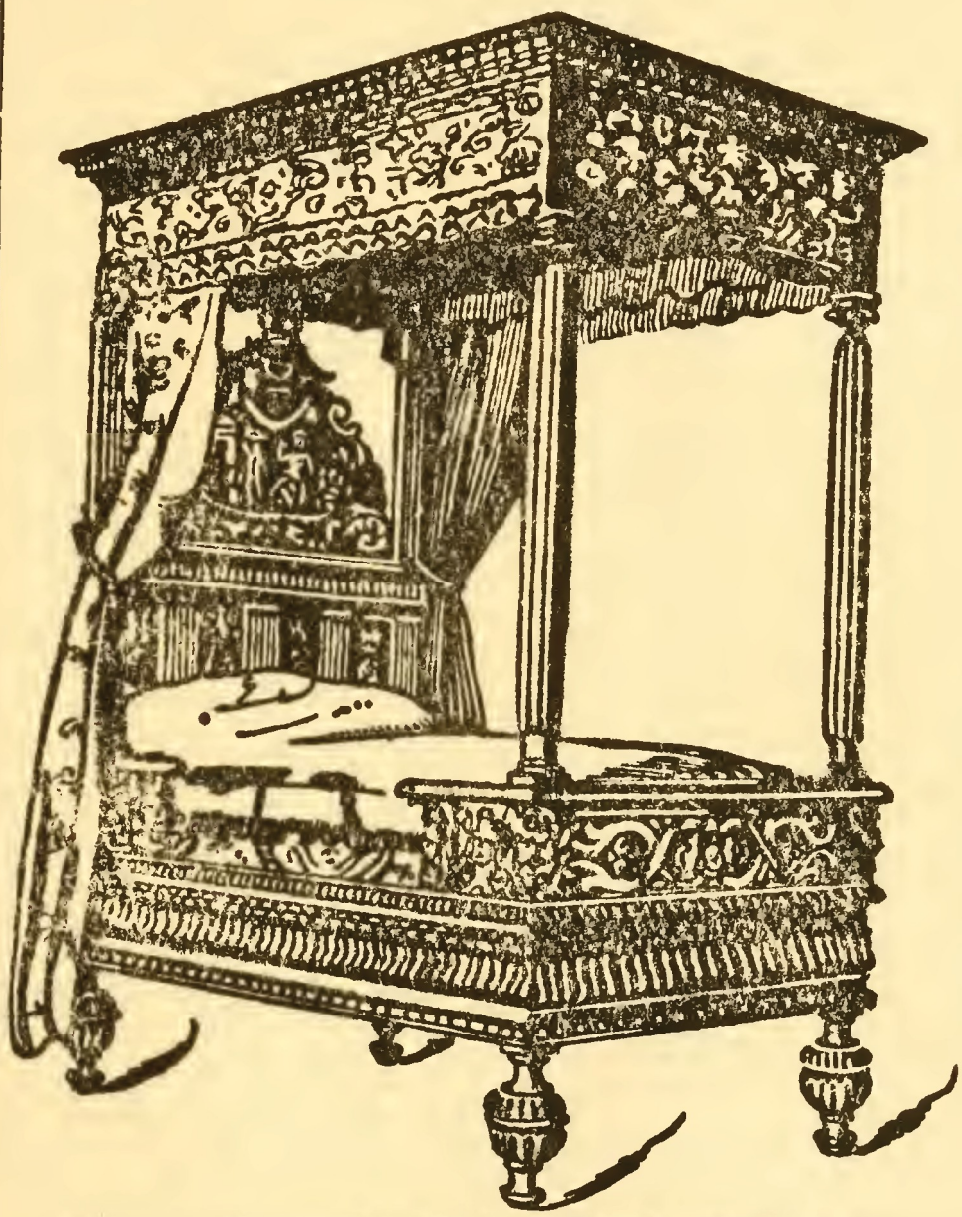
L.—Bread platter, sunk pattern ; sycamore or maple.

M.—Moulded serviette ring ; box or other fancy hard wood, such as olive wood.



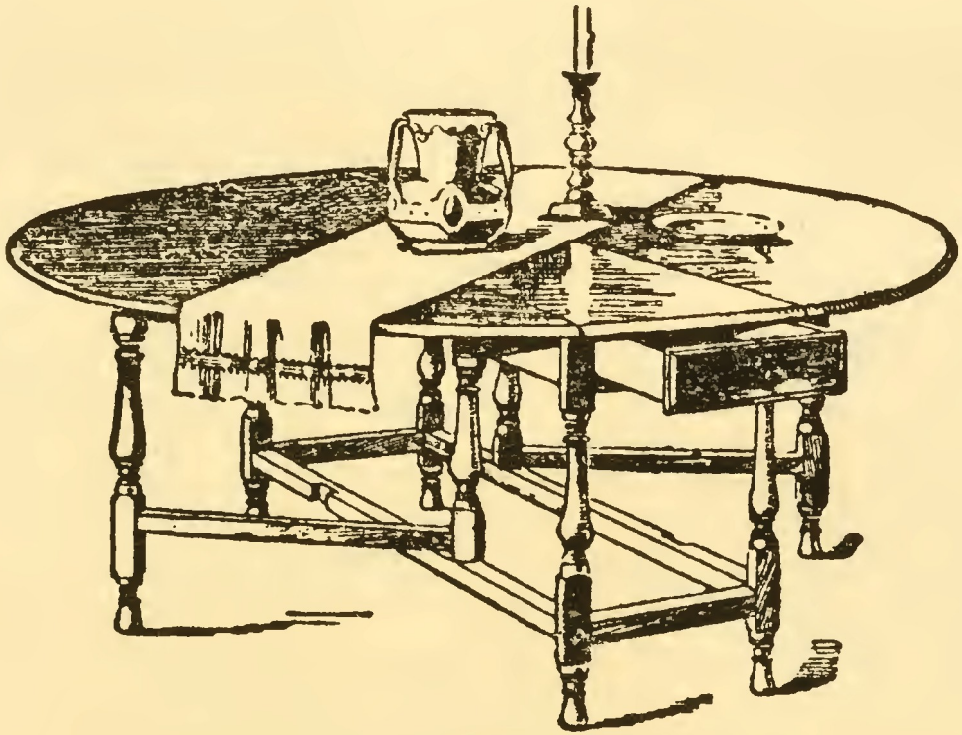
SET OF CHESSMEN, FULL SIZE.

Suitable woods are boxwood and ebony. The bottom of each piece is turned slightly concave, so that it will stand secure. The lower portion of the knight is turned with a small pin on it so as to engage with a hole which is bored into the horse's head. The upper portion forming the head is hand-carved.



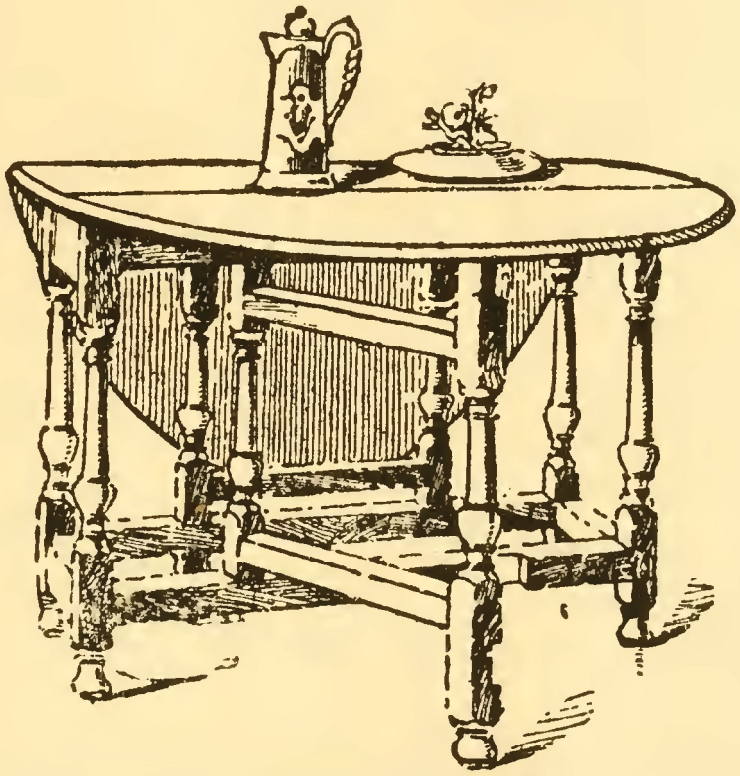
BED OF CATHERINE DE MEDICI, WITH TURNED POSTS AND FEET.

(*From "The Woodworker," 1919 Volume.*)



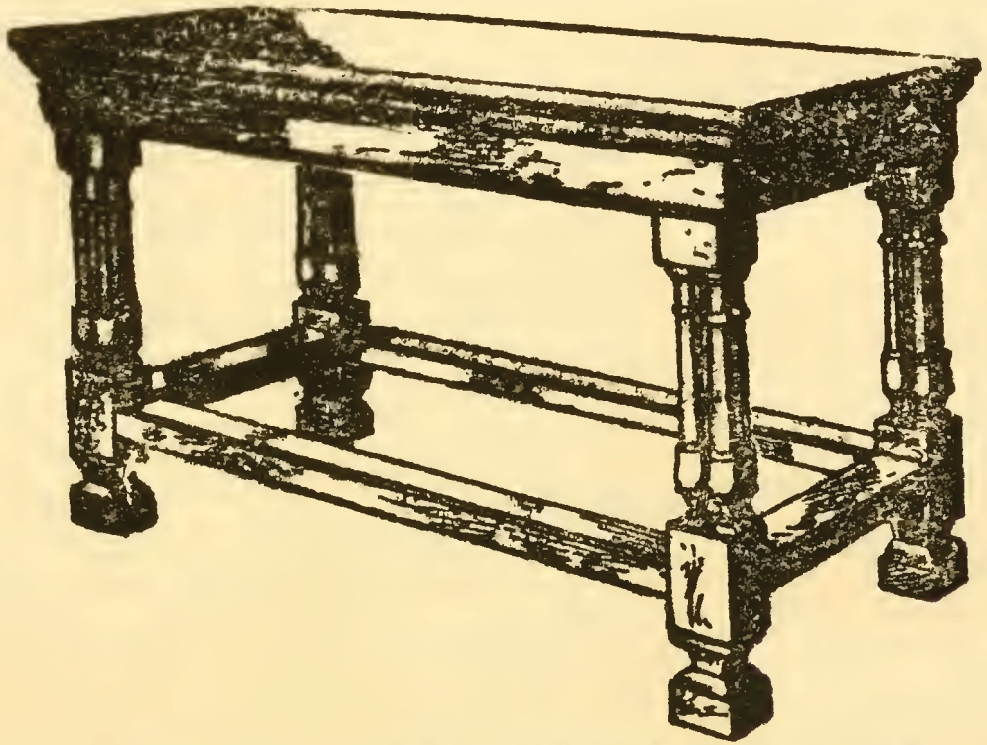
GATE-LEG TABLE—CROMWELLIAN TYPE.

(*From "The Woodworker," 1919 Volume.*)



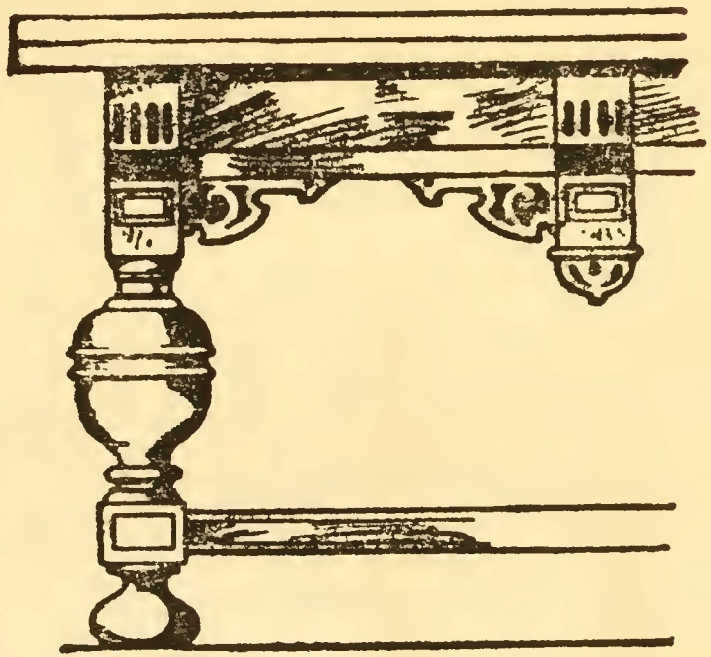
GATE-LEG TABLE—CROMWELLIAN TYPE. VIEW WITH FLAP DOWN.

(From "The Woodworker," 1919 Volume.)

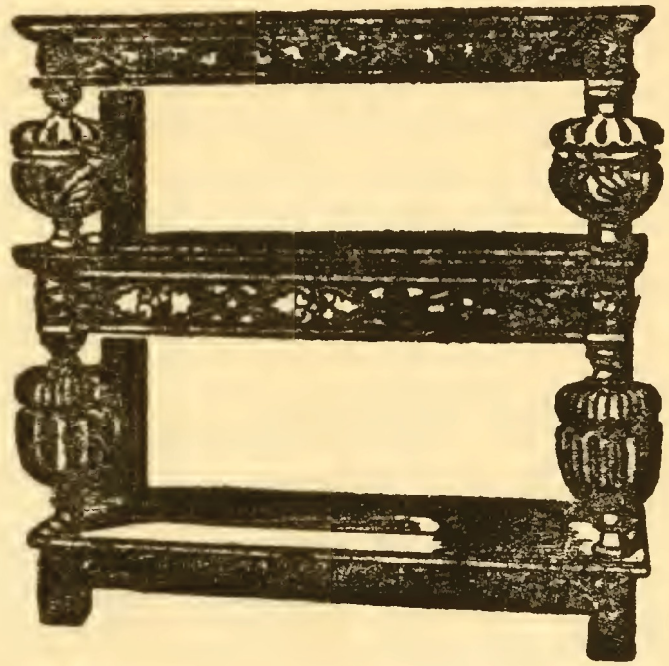


SEVENTEENTH CENTURY TABLE, EACH LEG WITH FOUR TURNED COLUMNS.

(From "The Woodworker," 1919 Volume.)

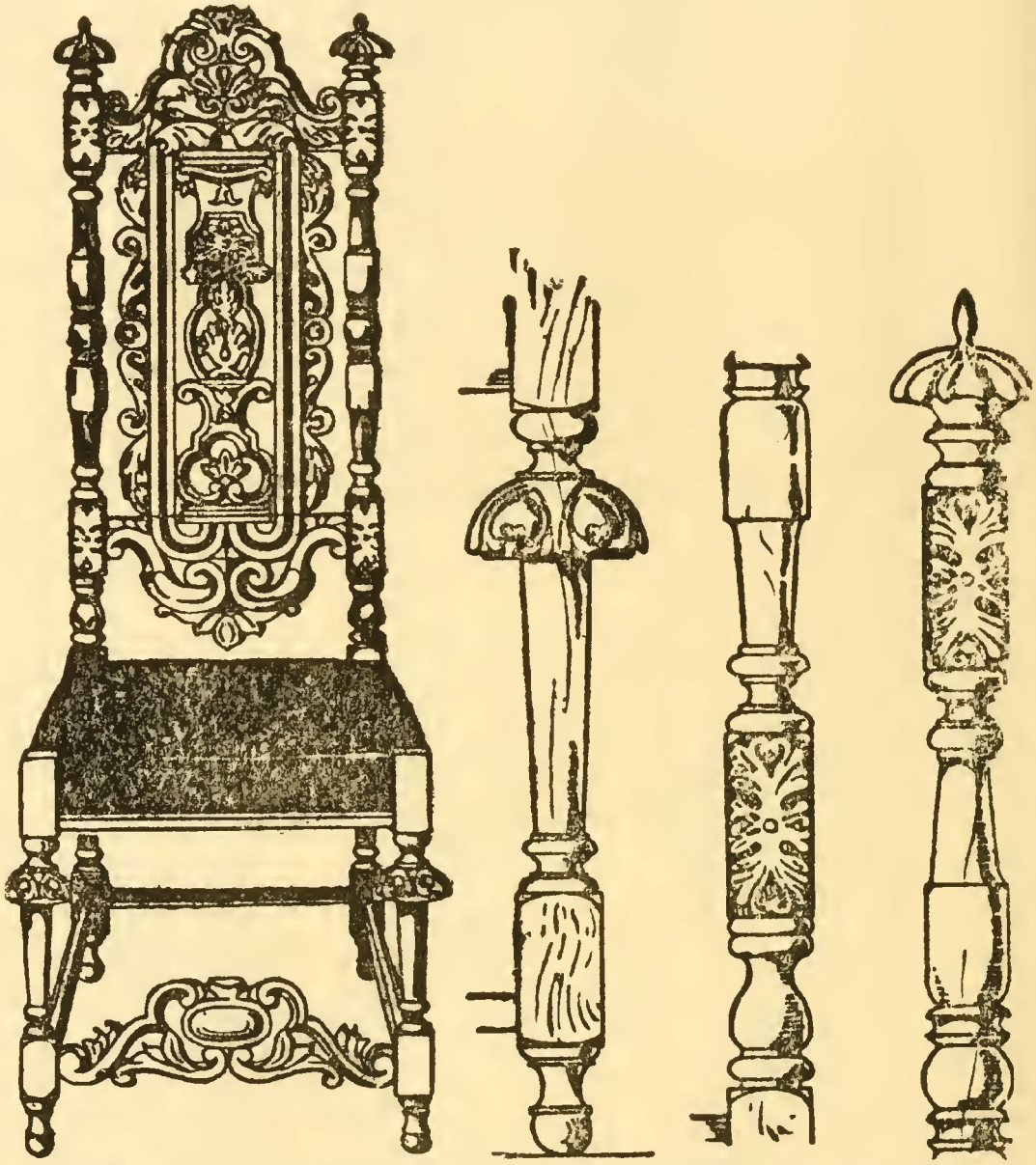


DUTCH DRAW-EXTENSION DINING-TABLE, WITH BULBOUS TURNED LEGS.



DRESSER OF TUDOR PERIOD, WITH HEAVY BULBOUS TURNINGS.

(*From "The Woodworker," 1919 Volume.*)

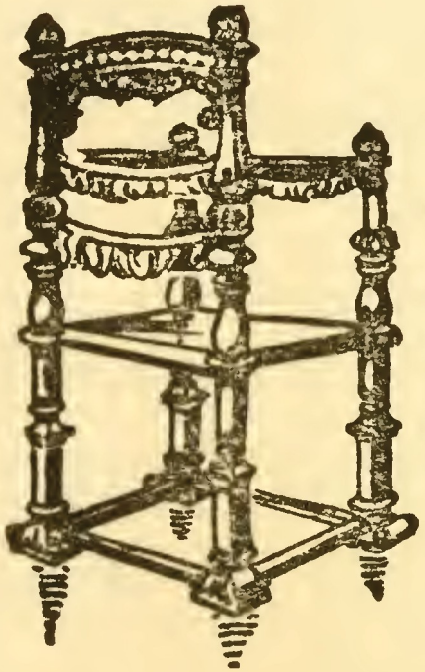


SEVENTEENTH CENTURY CHAIR WITH TURNED LEGS AND BACK UPRIGHTS. DETAILS OF TURNING SHOWN.

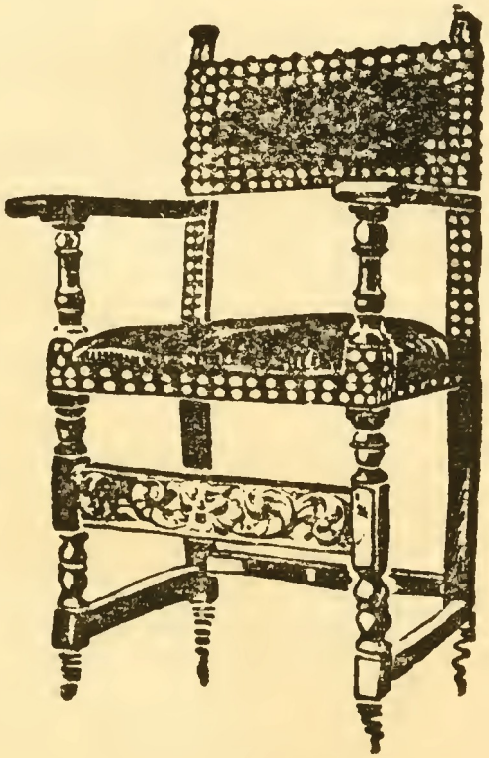
(*From "The Woodworker," 1919 Volume.*)

SEVENTEENTH CENTURY OAK CHEST
WITH TURNED LEGS.

(From "The Woodworker," 1919 Volume.)

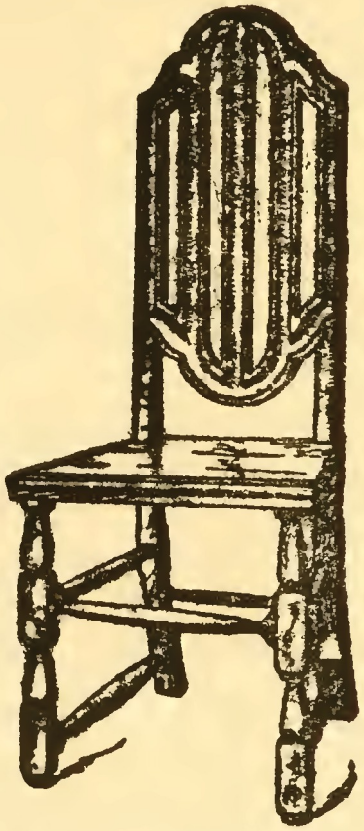


FRENCH CHAIR OF
FRANCIS I. PERIOD.

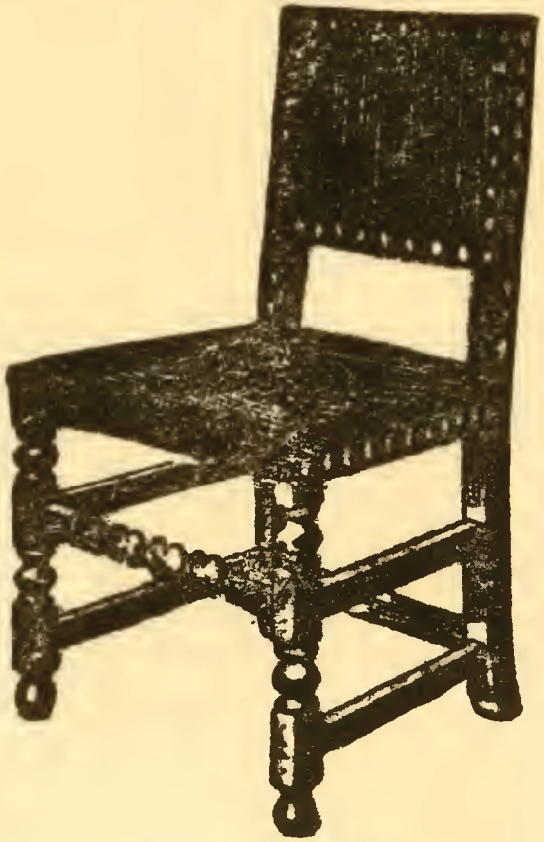


FRENCH CHAIR OF
HENRI II. PERIOD.

(*From "The Woodworker," 1919 Volume.*)

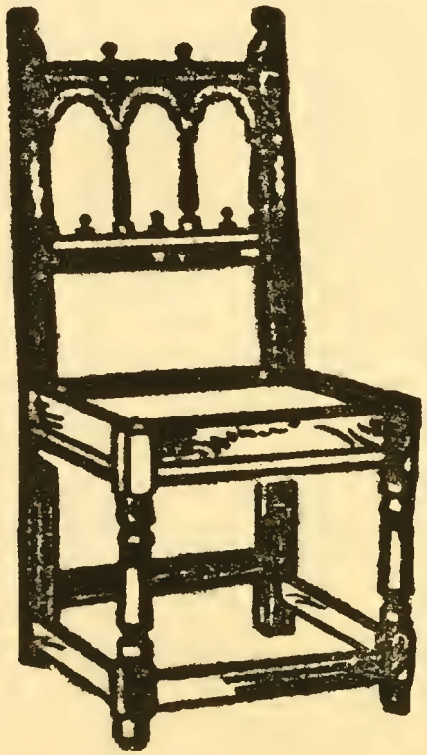


CHAIR IN JOHN KNOX'S STUDY (EDINBURGH).

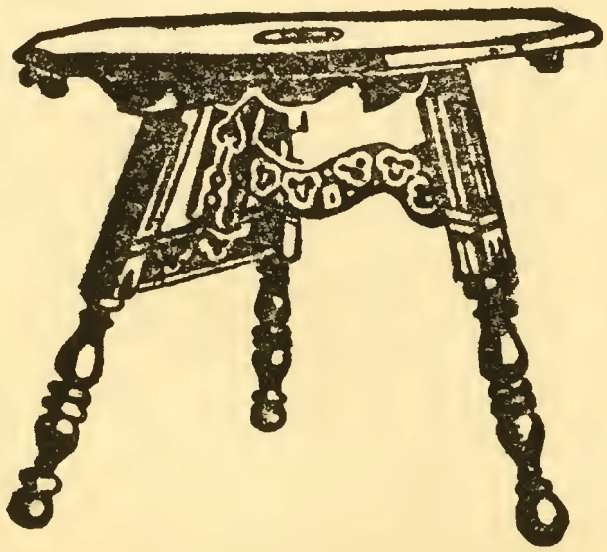


CROMWELLIAN CHAIR.

(*From "The Woodworker," 1919 Volume.*)



STUART CHAIR.



FLEMISH TABLE.

(From "The Woodworker," 1919 Volume.)

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